BRAC TO THE FUTURE: AN ANALYSIS OF PAST SAVINGS FROM BASE CLOSINGS

THESIS

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Table of Contents

Page

List of Figures

List of Tables

Abstract

This thesis uses regression to analyze the savings resulting from the previous four rounds of BRAC in terms of their affect on each of the Air Force budget appropriations. For each appropriation, while the number of major installations initially appears to be a significant determinant in explaining the change in the budget, the number of bases becomes insignificant if a surrogate for Air Force mission requirements is included as the explanatory variable. We tested three surrogate measures for mission requirements: number of flying hours, number of aircraft, and number of active duty personnel. In each case, we found the number of active duty Air Force members to be a better predictor of the budget level than the regression model that included the number of major installations. We conclude that mission requirements are a better indicator of the required funding than the number of major installations.

BRAC TO THE FUTURE: AN ANALYSIS OF PAST SAVINGS FROM BASE CLOSINGS

1. Introduction

1.1. The Reality of Base Closings

> It is a rare spectacle that takes place in the corridors of the Pentagon the day the Defense Department releases the list of bases it intends to close. People gather outside room 2E765, the public affairs office. They're not reporters; they're employees and officials from potentially affected bases trying to discover if their bases will survive. The reporters march into the grey and blue newsroom in a solemn procession, sign a paper, and are handed the thick, yellow-covered list of recommended closings. Once out in the hallway, the anxious onlookers descend on the reporters bearing the lists. It's like the scene from the short story *The Lottery*, as each clamors to discover whether the draw will let him live or die. There is wild rejoicing as some discover their bases have been spared. And there is also deep dejection—indeed, to the point of tears—when some bases are targeted. Few other things so vividly drive home the consequences of the base realignment and closure process and its human impact than this Pentagon scene…
>
> - David Silverberg, *"BRAC Attach!"* [17:40]

Since the end of the Cold War in the late 1980s, the Department of Defense has had the daunting task of paring down the nation's military infrastructure commensurate with the reductions in the mission, personnel, and defense budget. Under the authority granted by Congress, an independent Base Realignment and Closure (BRAC) Commission has worked with the Defense Department on four separate occasions to provide the Executive and Legislative branches with a list of installations recommended

for closure. Subsequently, approval was granted to close 97 of 495 major domestic installations, as shown in Appendix A [15:12].

As a result of these necessary actions, the dissemination of the recommendations from the independent BRAC Commissions have resulted in several iterations of the aforementioned scenario of dejection. And undoubtedly, as Congress considers the Defense Department's request for the authority to initiate two additional rounds of closure and realignment actions, the image of disheartenment and disappointment will weigh heavy on their minds as they weigh the costs and benefits of subsequent rounds.

1.2. Research Problem

Following the end of the Cold War, the United States military has been able to significantly reduce its alert posture. For example, the Minutemen II operation was cancelled in 1991 and bomber crews are no longer maintained within minutes of executing their missions. With current views that economic competition is more important than military readiness, the military budgets have been significantly reduced. Thus, the military services are continually in search for means to be more efficient with the budgets prescribed by the civilian leadership.

"Since the height of the Cold War, the defense budget has been reduced by about 40 percent, overall force structure has been reduced by 36 percent, and procurement has decreased by almost 70 percent; yet, during the same period, the number of bases in the United States has dropped by only 21 percent (26 percent world-wide)" [7]. The reductions in the budget, force structure, and procurement strongly suggest the need for further reductions in base infrastructure, as DoD contends there should be a one-to-one

ratio between percentage changes in force structure and infrastructure. Additional base closings may afford the Defense Department the means to reduce infrastructure costs and reallocate resources for more efficient use.

In the 1997 Quadrennial Defense Review (QDR) and 1998 Report of the Department of Defense on Base Realignment and Closure (BRAC Report), the Honorable William Cohen, Secretary of Defense (SECDEF), expressed the need for two additional rounds of BRAC. The need for the two additional rounds is predicated on the concept of eliminating excess installations to achieve a proper balance between our military infrastructure and force structure. Furthermore, DoD contends that the savings generated by BRAC could be used to fund future readiness and weapons modernization and acquisition programs, if Congress were to fund the Defense Department in accordance with the Future Years Defense Plan (FYDP).

In spite of the anticipated benefits resulting from the elimination of excess infrastructure, the ensuing economies of scale, and extensive long-term savings as touted by the BRAC Report, the Defense Department has received major opposition from civilian leadership on Capitol Hill. "Many members of Congress have been reluctant to support additional base closure rounds because they were concerned about the costs and savings from prior base closure rounds, their economic impact, and executive branch implementation of the 1995 BRAC Commission's recommendations regarding McClelland and Kelly Air Force bases in California and Texas, respectively" [11:34]. The consternation of Congress has resulted in the rejection of several proposed amendments to the National Defense Authorization to establish additional rounds, the most recent in June 2000.

The biggest point of contention, however, rests on the costs and savings attributed to the first four rounds. Current accounting systems make it extremely difficult to track detailed cost in budget data because the financial data is so aggregated. When costs are identified, it is difficult to determine if these costs attributed to BRAC would have occurred in its absence [13:4]. For instances, would the permanent change of station costs attributed to base closures occurred due to normal military transfers, or is the reduced personnel cost derived from the decreased mission with the end of the Cold War or from base closures? More difficult than determining costs, it is impossible to track savings in the budget data. The accounting systems used by the Defense Department do not have the capability to assess savings, therefore, DoD uses estimates from the Cost of Base Realignment Actions (COBRA) model—a model designed specifically to compare BRAC options as opposed to measuring specific cost and savings estimates.

As DoD postures itself for a new administration, a possible recession, and the potential for more budget cuts, a decision about the need for additional base closings is crucial. In the absence of definitive cost and savings information, this research attempts to substantiate savings attributed to BRAC based on changes in the aggregate budget.

1.3. Research Objective

This research tests whether the number of major installations drives the Air Force budgets and expenditures, or if surrogate measures for Air Force mission requirements provide a more reasonable explanation. We accomplish this by developing descriptive models using Air Force budget data to illustrate the impact of the number of major installations versus surrogate measures of Air Force mission requirements.

The Defense Department financial community, particularly as it prepares for the Quadrennial Defense Review, may find this analysis insightful. We believe this research may serve as a foundation for subsequent analyses on the effects base closures have on the aggregate budget and may provide insight for similar analyses for the other services.

1.4. Thesis Outline

This thesis is organized into four major chapters. Chapter 2 provides an overview of the Cold War and its impact on the posture of the US military. Chapter 3 presents an overview of BRAC, the costs and savings associated with its implementation, and items for consideration for future rounds. The objective of Chapters 2 and 3 is to provide a synopsis of the events that led to the US to maintain its largest standing military force during peacetime, and the actions implemented to reduce the infrastructure during the subsequent draw down at the end of the Cold War. Chapter 4 provides an explanation of the research methodology used to address the research problem and results of the analysis. The final chapter, Chapter 5, presents the conclusions of this thesis and recommendations for future studies.

2. Effects of the Cold War

2.1. Introduction

"From the rise of the Iron Curtain in 1946 to the collapse of the Soviet empire in 1991," the nuclear arms race between the world's two superpowers had a looming impact across the world [4]. Far-reaching political alliances and stringent economic sanctions against communist countries resulted from this confrontation between military giants, but perhaps the most significant effect of the war was the establishment of a large-standing US military force during peacetime.

This chapter provides a brief overview of the Cold War, its effects on the US military, and the transition of the armed forces to a post-Cold War posture after the toppling of communism in Eastern Europe in 1989 and the subsequent dissolve of the USSR in 1991.

2.2. Cold War [3]

"Cold War", a term popularized by American journalist Walter Lippman, labels the post-World War II struggle between the United States and its allies and the Union of Soviet Socialist Republics (USSR) and its allies from the mid-1940s until the late 1980s. During this period, international politics were heavily shaped by the intense rivalry between these two superpowers and the political ideologies they represented: democracy and capitalism in the case of the United States and its allies, and communism in the case of the Soviet bloc.

As victory in World War II was imminent for the Grand Alliance, the American-British-Soviet coalition, the United States and Soviets had a vast disagreement on the

make-up of the postwar world, particularly concerning the future of Poland. The USSR believed Poland was vital to the security of the Soviet Union, and in 1946 and 1947 helped bring communist governments to power in Poland and the neighboring states of Romania, Bulgaria, and Hungary.

As the impetus for the Cold War, this spread of communism under the leadership of Josef Stalin caused relations between the USSR and its World War II allies (primarily the United States, Britain, and France) to deteriorate to the point of war, although an actual occurrence of warfare did not occur. Over the next few years, the emerging rivalry between these two camps hardened into a mutual and permanent preoccupation. It dominated the foreign policy agendas of both sides and led to the formation of two vast military alliances: the North Atlantic Treaty Organization (NATO), created by the Western powers in 1949; and the Soviet-dominated Warsaw Pact, established in 1955. Although centered originally in Europe, the Cold War enmity eventually drew the US and the USSR into local conflicts in almost every quarter of the globe. It also produced what became known as the "Cold War arms race", an intense competition between the two superpowers to accumulate nuclear weapons.

2.3. Effects on the US Military Force Structure [8]

Throughout the Cold War, the US was guided by a national security strategy of containment. It was a simple concept based on the idea that the centers of power for communism were the Soviet Union, its satellites, and China. In the late 1940s and early 1950s, when this strategy was put into effect, the goal was to contain communism by forming alliances and building military bases around these centers of power to prevent

them from physically expanding. This strategy forced a change in the familiar security paradigm of the United States. When these installations were built around the world, they could not be staffed them with people from the Guard and Reserve. For the first time in peacetime, the US had to maintain a large-standing military force. The Defense Department had to field large numbers of active-duty people—soldiers, sailors, airmen and Marines—and have them forward deployed. These forces also required a large support base and rotation pool in the United States.

The US military, however, has changed rather dramatically since the end of the Cold War. In the late 1980s and early 1990s when we saw the Berlin Wall come down (1989), the Warsaw Pact disintegrate (1991), and, eventually, the Soviet Union come apart (1991), the US political leaders were far out in front of the military in recognizing the momentous nature of these changes and the need to restructure the American military.

These events caused a shift in America's national priorities. Most notable to those in the military were the decreases in the defense budgets and the beginning of what many people called "downsizing". Some contend that these steps should have been characterized as "demobilization". As a nation, the US has always had a militia mind-set—we mobilize and use whatever resources are necessary to meet a challenge or to win a war; and, when it's over, we demobilize (or in other words, significantly reduce our standing military) and that's what really happened at the end of the Cold War.

Many Americans grew up with the massive military structure during the Cold War. Many people came to believe the United States always had a large-standing military force that was forward deployed, and this was the way things would always be. However, this structure had to change because of the political shifts in Europe and the

Soviet Union that started in the late 1980s. President George H. W. Bush recognized the nation needed a new national security strategy, and in the fall of 1990 he charged the National Security Council with developing a post-Cold War strategy.

As this strategy was being developed, we began to bring troops back from overseas bases. As we did so, we looked at several aspects of our forward presence policy. First, we asked whether the function or mission the troops performed was still required in the post-Cold War environment. If it was not required, then we disbanded the units and demobilized those troops; if we thought the function or mission was required, but could be placed with the Guard or Reserve because of a longer mobilization time, then we did so. Troops would only be kept on active duty as a last resort. In the end, the majority of these active units would be part of a contingency force based in the United States. The military would have just enough forward presence to facilitate the reintroduction of troops if they were required to provide humanitarian assistance, to aid an ally, or to unilaterally defend some vital US interest.

As a result of this approach, the United States made some dramatic reductions in the numbers of people in the armed forces. At the end of the Cold War, the US had 2.1 million men and women under arms in the active force. After this strategy development process, the force was reduced to 1.4 million service members by October 1, 1995.

3. BRAC Overview

3.1. Introduction

As the Department of Defense postures itself to meet the fiscal and operational challenges in the post-Cold War era, Joint Vision 2020, the 1997 Quadrennial Defense Review (QDR), and the Defense Reform Initiative (DRI) all point to the need for drastic, continuous transformation in the Defense Department [5:5-11]. The Defense Department firmly believes a major component of this period of transformation is its ability to close installations that no longer hold value in the national defense strategy—a task accomplished through the Base Realignment and Closure (BRAC) process. Specifically, DoD contends that the ability to initiate two additional rounds of BRAC will promote the effective and efficient use of the scarce fiscal resources prescribed by our civilian leadership and provide savings to further sustain readiness and bolster a force of aging weapons systems.

This chapter outlines the BRAC process, as well as the costs and savings reported by DoD resulting from the initial four rounds. Additionally, this chapter provides an overview of issues for consideration as DoD and Congress contemplate future rounds of base closures.

3.2. Base Realignment and Closure: The DoD Perspective [5:3]

From the end of Vietnam until the late 1980s, congressional concern about the potential loss of jobs in local communities resulted in very few bases being studied or recommended for closure. These circumstances prevented DoD from adapting its base

structure to the significant changes in forces, technologies, organizational structures, and military doctrine. However, the end of he Cold War and the associated reductions in the size of the military increased the number of installations that were candidates for closure and realignment to a point where they could no longer be ignored.

To address this problem, Congress created the BRAC process, which works as follows: DoD carefully evaluates and ranks each base according to a published plan for the size of future military forces and to a published criteria, adopted through a rule-making process prior to each round, starting with the 1991 round. The criteria have been the same for each round and have included military value, return on investment, environmental impact, and economic impact on the surrounding communities. The Secretary of Defense then recommends to an independent BRAC Commission bases for closure and realignment. The Commission, aided by the General Accounting Office, performs a parallel, public review of these recommendations to ensure that they are, indeed, consistent with the Department's force structure plan and selection criteria. The Commission then submits its recommendations to the President. The President and Congress must either accept these recommendations in total or reject the entire package.

Through its attributes of transparency, auditability, and independence, the BRAC process has permitted both Congress and the President to support important but politically painful adjustments in DoD's base structure.

The Defense Authorization Amendments and Base Closure and Realignment Act of 1988 (BCRA 88, Title II of Pub. L. 100-526, 10 U.S.C. Section 2687 note), and the Defense Base Closure and Realignment Act of 1990 (DBCRA 90, Part A of Title XXIX

of Pub. L. 101-510, 10 U.S.C. Section 2687 note) list the requirements for identifying and implementing domestic military base closures and realignments.

3.2.1. Overview of BRAC Implementation Costs [5]

BRAC implementation costs consist of the one-time expenses associated with the overall base closure and realignment effort. The key characteristics of such costs are that they are directly related to implementing a BRAC action; for example, they would not be incurred except for the BRAC action. These costs represent the near-term investments required to generate long-term BRAC savings. The Defense Department currently estimates that implementing the four prior BRAC rounds will cost approximately $23 billion from 1988 through 2001.

Two separate budget accounts have been established for BRAC implementation costs. The DoD Base Closure Account provides funding to implement BRAC 88 actions; the DoD Base Closure Account 1990 provides funding to implement BRAC 91, 93, and 95 actions. Both accounts are part of DoD's overall budget for military construction, though they pay for many BRAC-related activities in addition to construction, such as relocating personnel and equipment and performing environmental remediation. The BRAC budget accounts include the following categories of spending:

- Military construction: New facilitates or alterations to existing facilities at the gaining installations to accommodate the influx of equipment and personnel
- Family Housing: Construction of new housing units
- Operations and Maintenance: Established to pay for a variety of operation and maintenance costs, such as severance pay for civilian employees, moving costs for civilian employees who relocate, transportation of equipment, some real property maintenance, and program management. BRAC accounts pay for caretaker costs, but not facility-related operation and maintenance activities prior to closure and the establishment of a caretaker regime
- Military Personnel, Permanent Change of Station: BRAC accounts pay for moving personnel and their dependents from closing and realigning bases to

other installations. They also pay for travel, subsistence, and related costs of temporary duty for these military personnel

- Environmental Restoration: BRAC accounts fund environmental restoration.

The law requires DoD to complete implementation of each BRAC action within six years of the date on which the President transmitted to the Congress the report that approved the action. The Department begins to implement each BRAC round, and therefore begins to incur the one-time implementation costs in the fiscal year immediately following approval of the round, and continues to incur costs, until the end of the six-year period. For example, DoD will incur costs for BRAC 95 from fiscal year 1996 to fiscal year 2001.

In addition to the aforementioned costs, there are expenses incurred in support of BRAC actions that are funded outside of the BRAC accounts. The categories of expenses would include:

- Economic assistance
  - DoD's Office of Economic Adjustment: Issues grants to help communities affected by BRAC establish local organizations to plan base reuse and to assist with their economic adjustment
  - Department of Labor: Assists displaced workers through counseling, retraining, and job search assistance
  - Commerce Department's Economic Development Administration: Provides grants to improve former bases' infrastructure as a means to facilitate base reuse
  - Federal Aviation Administration: Issues grants to fund capital improvements to convert former military airfields into new civilian airports
- Unemployment compensation
- Early retirement and voluntary separation costs
- Health care

These one-time costs indirectly associated with BRAC are considered to be small. As noted in the Defense Department's 1998 BRAC Report, the costs imposed on other government programs are less than five percent of BRAC implementation costs.

3.2.2. Overview of BRAC Savings [5]

DoD defines savings as the difference between (1) what the Department would have spent in the absence of the BRAC process to operate its base structure and (2) what the Department actually spent (or plans to spend) for this function, plus gains in efficiency that would not have been possible without BRAC.

BRAC creates savings because it permits DoD to avoid costs that it would have incurred were it not for BRAC. First, BRAC saves base operating support costs, such as the costs to "open the doors and turn on the lights". Second, BRAC saves other costs because consolidation tends to increase efficiency. In the absence of the BRAC process, the Department is effectively prohibited from gaining efficiencies through relocating and consolidating major functions.

BRAC savings can be grouped into two categories: those that recur and those that are one-time savings. Recurring savings would be those that represent permanent, on-going reductions in planned spending, for example, personnel positions eliminated would represent recurring savings. One-time savings include savings that do not recur year after year, for example, cancelled military construction projects; one-time savings also take the form of revenues generated from the lease or sale of properties.

Savings derived from BRAC do not represent direct reductions in DoD's annual spending. Neither are they accumulated assets to be spent at some future time. Rather, the reduction in expenditures associated with the realignment or closure of military installations gives the Defense Department a way to meet budget targets and to fund priority functions that it could not accommodate in the absence of BRAC-related economies. Furthermore, budgetary adjustments for expected BRAC savings are made as

part of the normal planning, program, and budgeting system (PPBS) process. No audit trail, single document, or budget account exists for tracking the end use of each dollar saved through BRAC.

It has been DoD's policy to allow the Military Departments to retain and reallocate their BRAC savings. After BRAC recommendations are approved, each Military Department applies the estimated savings to its long-term spending plans and uses them to fund higher priorities.

3.3. The Need for Additional Closures

"Today, the US military finds itself operating at an intense pace around the globe—more so than at any peacetime in our history. But defense spending has been declining in real terms every year since 1985, and military planners assume that this decline will continue for the foreseeable future" [10]. Since the height of the Cold War, the defense budget has been reduced by approximately 40 percent, overall force structure has been reduced by 36 percent, and procurement had decreased by almost 70 percent; yet, during the same period, the number of domestic bases has dropped only 21 percent [2; 7].

Based on the findings in the DoD BRAC Report, after the on-going closure and realignment efforts resulting from the four previous rounds of BRAC are complete in 2001, the Department will still have more bases than are needed to support our nation's military forces [5:i]. Moreover, maintaining and operating an inert base structure that is larger than necessary has broad consequences for the Department; these consequences fall into two categories [5:ii, 2]:

- *Strategic.* New BRAC rounds are of fundamental importance to our defense strategy. Without new BRAC rounds, DoD will not be able to implement the strategy outlined in the Quadrennial Defense Review. In the absence of BRAC, DoD will have to decide whether to reduce force structure, delay the introduction of more modern weapons for our troops, or reduce funding for quality of life.

- *Financial.* DoD wastes money operating and maintaining bases that are not essential to national defense. Future BRAC rounds will enable the Department to generate savings by eliminating existing excess capacity and use those resources to maintain readiness and modernize our forces. BRAC will also help eliminate the additional excess capacity created as DoD reengineers business practices and consolidates organizations.

3.4. The GAO Perspective on BRAC Savings

As the investigative arm of Congress, the General Accounting Office (GAO) has reviewed the costs and savings reported by DoD. Upon review of DoD's claims, GAO suggests that ambiguous costs and savings estimates, inferior accounting systems, and mounting environmental cleanup costs have tainted DoD's ability to present more accurate cost and savings information as they apply to BRAC.

Changes and uncertainties regarding BRAC implementation costs and savings have been caused by a variety of factors, beginning with how the estimates were initially calculated and later updated or tracked.

> DoD derived initial BRAC cost and savings estimates from the Cost of Base Realignment Actions (COBRA) model, which was used in each of the past four BRAC rounds to develop comparative costs of alternative actions. This model, while useful for initial BRAC decision-making, was not intended to produce budget quality data and was not used to develop the cost estimates in the budgets for implementing BRAC decisions [14:24-25].

Data developed for the budget submissions differ from those in COBRA for a variety of reasons, including the following [15:38-39]:

- Some factors in COBRA estimates are averages, where budget data are more specific.
- COBRA costs are expressed in constant-year dollars; budgets are expressed in inflated dollars.
- Environmental restoration costs are not included in COBRA estimates, but these costs are included in BRAC implementation budgets.
- COBRA estimates show costs and savings pertinent to a given installation even if multiple tenants are involved; BRAC implementation budgets represent only a single component's costs.

Furthermore, the estimates for savings have not been developed consistently across the services. "The Army and the Navy did not use the model to develop the savings estimates that were reported in DoD's budget justifications for the BRAC accounts, while the Air Force used the COBRA estimates, with adjustments for inflation and recurring cost increases at gaining bases, as the basis for developing its savings estimates" [14:24-25].

Figure 1 further illustrates the factors that have made it difficult to fully identify and track savings from closures or led to changing estimates of costs over time which affected when savings would begin to offset the costs [14:24].

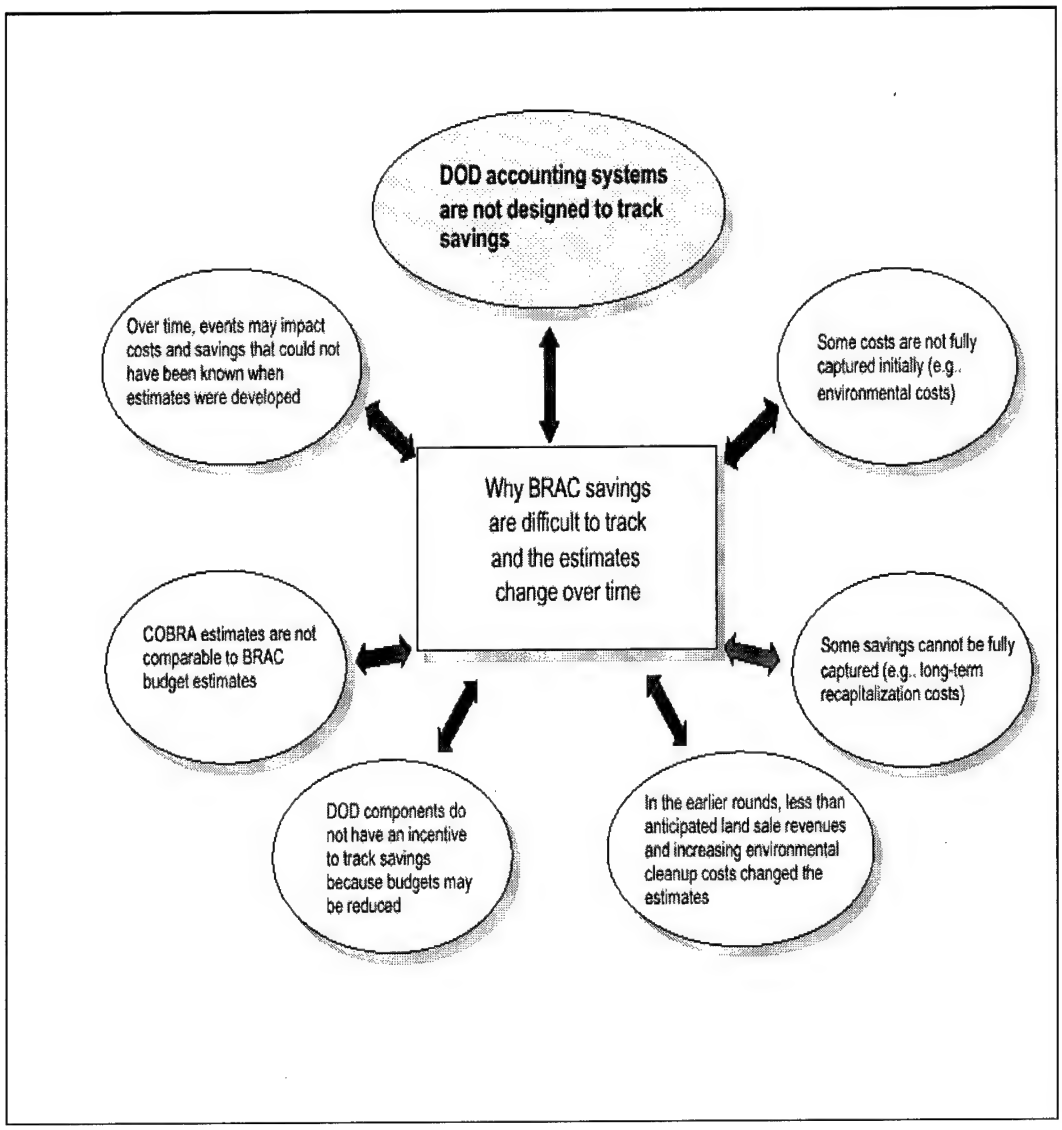


Figure 1. Why BRAC Savings are Difficult to Track and Estimates Change Over Time

A fundamental limitation in DoD's ability to identify and track savings from BRAC closures and realignments is that DoD's accounting systems, like all accounting systems, are oriented to tracking expenses and disbursements, not savings. Savings estimates are developed by the services at the time they are developing their initial BRAC implementation budgets and are reported in DoD's BRAC budget justifications. Because the accounting systems do not track savings, updating these estimates requires a separate data tracking system. The lack of updates is problematic because the initial estimates are based on forecasted data that

> can change during actual implementation, thereby increasing or decreasing the amount of savings [14:25-26].

Moreover, "DoD cannot provide accurate information on the actual savings because (1) information on base support cost was not retained for some closing bases and (2) the services' accounting systems cannot isolate the effect on support costs at gaining bases" [13:4]. In spite of the criticism the Department has received from its inability to accurately identify and track savings from BRAC actions, DoD officials state that designing and implementing a system for collecting actual savings information would be difficult and extremely expensive, and they questioned the value of such a system [13:4].

In addition to the nebulous estimates and inferior accounting systems, the costs of implementing BRAC recommendations have been greater than DoD originally estimated. Land sale revenues were less than projected, particularly in the earlier rounds, and environmental cleanup costs are significantly higher—by the end of the legislated BRAC implementation period, it is expected that DoD will have spent over $7.2 billion dollars in environmental costs, with an additional estimate of $2.4 billion to continue beyond fiscal year 2001 [15:6]. The key factors contributing to the mounting cost of cleanup are (1) the number of contaminated sites and difficulties associated with certain types of contamination, (2) the requirements of federal and state laws and regulations, (3) the lack of cost-effective cleanup technology, and (4) the intended property reuse [12:9]. Additionally, as DoD retains hundreds of thousands of acres until the property is able to meet transfer requirements, costs associated with a caretaker force continue to accumulate for the Department, ultimately lessening overall BRAC savings.

3.5. Cost Savings Versus Cost Avoidance

The General Accounting Office claims, "despite the imprecision associated with DoD's cost and savings estimates, our analysis continues to show that BRAC actions will result in substantial long-term savings after the cost of closing and realigning bases are incurred" [15:43]. As reported by the General Accounting Office, there is evidence indicating that the long-term savings that BRAC will generate, as a result of creating economies through the reduction of excess infrastructure, should be substantial. Though, it must be noted that the "savings" claimed by DoD are cost avoidance. It is important to note the distinction between cost savings and cost avoidance: cost savings are simply cost reductions from an approved budget that result in program funds being recouped or used elsewhere, and cost avoidances are the avoidance of costs that have not been budgeted [14:6].

As reported in the DoD fiscal year 1999 BRAC budget submission, the net cumulative savings from all four rounds through fiscal year 2001 should be approximately $14 billion, as shown in Table 1; however, because a majority of the savings occur after the six-year BRAC/FYDP implementation period, they would be more along the lines of cost avoidance as opposed to direct FYDP adjustments [1:8; 15:37].

Table 1. DoD FY 1999 BRAC Budget Submission

$ Billions						
Round	6-Year Period	Costs	Savings	Net annual recurring savings	Total savings through 2001	Net savings through 2001
BRAC 88	1990-1995	$2.7	$2.4	$0.8	$6.9	$4.2
BRAC 91	1992-1997	5.2	6.4	1.5	12.4	7.2
BRAC 93	1994-1999	7.7	7.5	2.1	11.7	4.0
BRAC 95	1996-2001	7.3	5.9	1.3	5.9	(1.4)
Total		$22.9	$22.2	$5.7	$36.9	$14.0

In the absence of a definitive explanation of the savings generated by the first four rounds, Congress is wary of authorizing the additional rounds requested by the SECDEF and the services.

3.6. Analysis of Air Force BRAC Savings

There have been many inferences about the savings within DoD being tied directly to the number of installations. However, previous studies on the savings, specifically the Air Force savings illustrated in the report for the Deputy Assistant Secretary (Cost and Economics), Financial Management, SAF/FMC, indicate a majority of the savings have been related to personnel cuts that resulted from decreased mission requirements. Of the Air Force savings attributed to BRAC, 86.7 percent of the total savings were resultant of reduction in personnel (53.79 percent from military personnel and 32.96 percent from civilian personnel), as highlighted by Table 2 [1:11].

Table 2. Financial Summary of all four BRAC rounds
US Department of the Air Force

$ Millions	
	FY90-FY01
COSTS	
One time implementation costs	$5,811
Implementation costs outside of BRAC account	310
Sub-total	$6,121
SAVINGS	
Military construction	$504
Family Housing Construction	70
Family Housing Operation	242
Operations & Maintenance	2,030
Military Personnel	3,313
Sub-total	$6,159
NET IMPLEMENTATION COSTS (+); SAVINGS(-)	$-38
Personnel-related Savings (O&M/ MilPers)	$5,343
Total Savings Credited to BRAC	$6,159
Personnel Savings/ Total Savings	86.7%

Based on this analysis presented in the SAF/FMC report, it would appear logical to evaluate the impact of the service members on the budget, in addition to the other surrogate measures for the Air Force mission requirements—number of aircraft and number of flying hours.

3.7. Summary

Undoubtedly, as the Defense Department prepares itself for the challenges of addressing new threats and retaining its posture as a dominant military power in the post-Cold War era, it is presumed that base closures will play a major role in reshaping our domestic infrastructure to eliminate installations that no longer hold military value, thus promoting more efficient use of military resources. Former Defense Secretary William Cohen emphasizes this in his cover letter in the April 1998 Office of the Secretary of Defense report, The Report of the Department of Defense on Base Closure:

> BRAC is critical to the success of our defense strategy. Without BRAC, we will not have the resources needed to maintain high readiness and buy the next generation of equipment needed to ensure our dominance in future conflicts [5].

In the absence of viable cost and savings data, however, it is difficult to substantiate the savings attributed to BRAC and provide definitive data to Congress as they consider future rounds. "Key requirements for calculating actual BRAC savings include information on decreased support costs at closing bases and the offsetting increases at gaining bases" [13:4]. (Note: The February 1992 DoD Base Structure Report defined base support costs as "the overhead cost of providing, operating, and maintaining the defense base structure, including real property, base operations costs, and family housing costs" [13:24].) As noted by GAO, DoD's inferior accounting systems, coupled with highly aggregated fiscal data, make it difficult to determine savings with any degree of certainty. Therefore this study will conduct research to determine whether changes in the aggregate budgets support the claim that closing major installations produces significant savings. Air Force data will be used for this research.

To evaluate the impact of each major installation, we will use regression to determine if a statistically significant relationship could be modeled between the number of installations and the budgets for the six appropriations. Subsequently, surrogate measures for the Air Force mission requirements will be used to determine if a mathematical relationship exists and if it provides a better measure than the number of installations.

4. Analysis of BRAC Savings

4.1. Introduction

To evaluate the potential savings of closing major installations, one should evaluate the monetary contribution of the number of installations to the budget. This research tests whether the number of major installations drives the Air Force budgets. We test the impact of the number of installations alone and along with measures of Air Force mission requirements. Ultimately, we compare the results of the individual analyses to determine which measure provides a more reasonable and justifiable statistical relationship with regards to claimed savings.

4.2. Statistical Analysis

This study employs regression using the Excel Data Analysis (Analysis ToolPak) add-in to evaluate the hypothesis that the budgets of the six Air Force appropriations can be explained with the number of major installations and surrogate variables for the Air Force mission level. The resulting descriptive models should provide insight into how the number of major installations and the Air Force mission requirements, as explained by the surrogate measures, can explain the appropriation budgets.

There are several overarching assumptions that were imposed for this analysis:

1. The number of active duty personnel, total number of aircraft, or flying hours is a surrogate measure for Air Force mission requirements.

2. Significant post-Cold War active duty personnel reductions are the result of reducing the Air Force mission level, as opposed to being driven by BRAC actions.

To test the research assumptions, we use major installations and three surrogate measures for Air Force mission requirements.

4.2.1. Regression Variables

As the Defense Department continues to contemplate two additional rounds of base closings, the focus continues to be on closing major installations. The Air Force defines major installations as Air Force Bases, Air Bases, Air Reserves Bases, and Air Guard Bases, that are self-supporting centers of operations for actions of importance to Air Force combat, combat support, or training. Each of the major installations is occupied by a unit of group size or larger with all land, facilities, and organic support needed to accomplish the unit mission.

Consistent with DoD objectives, we focused our research on identifying the impact of major installations on the Air Force budget. We did consider using minor installations for further analysis, however, we were unable to find a source for the number of minor installations using the current Air Force criteria for base classifications as discussed in Appendix B.

To test whether major installations or mission level drives the Air Force budgets, this research also considers the impact of surrogate measures for Air Force mission requirements:

This research hypothesizes that the conclusion of the Cold War led to the decline in the Air Force mission level, which subsequently led to significant reductions in the number of personnel on active duty. Moreover, the SAF/FMC report implies a causal link between the mission level and the number of active duty personnel and that the overwhelming majority of savings attributed to BRAC are actually from personnel

reductions [1:7]. To test this theory, we use active duty Air Force members as a surrogate measure of the mission requirements.

Air Force mission requirements also dictate the operations tempo. DoD defines operations tempo as "a measure of the pace of an operation or operations in terms of equipment usage—aircraft 'flying hours,' ship 'steaming days,' or 'tank (driving) miles'" [9]. Consistent with the Defense Department's definition, this research uses both the number of aircraft and the number of flying hours as surrogate measures of Air Force mission requirements.

This research also uses fiscal years based on the supposition that each subsequent budget is based primarily from previous year's requirements.

4.2.2. Data

To accomplish the task of building descriptive models, historical budgets for fiscal years 1960 – 2000 were obtained from the Automated Budget Interactive Data Environment System (ABIDES) database. To overcome current-year dollar distortion and to allow for year-to-year comparisons, the fiscal data was recalculated into constant fiscal year 2001 dollars.

In the absence of an all inclusive database for both fiscal and explanatory variables, the annual Almanac editions of the Air Force Magazine, from May 1973 – 2000, were used to create a database of major installations, active duty Air Force members, number of aircraft, and number of flying hours. In the five instances where data were missing (4 years for flying hours and 1 year for number of aircraft), we used mathematical interpolation to estimate the values.

The final database includes complete data from 1964, 1968, and 1972 – 2000, as shown in Appendix C.

We determined the number of major installations was highly correlated with the number of active duty Air Force members, number of aircraft, and number of flying hours, as shown in Table 3.

Table 3. Correlation of Independent Variables

	Active Duty Air Force	Major Installations	Aircraft	Flying Hours
Active Duty Air Force	1.00	.97	.97	.95
Major Installations	.97	1.00	.96	.92
Aircraft	.97	.96	1.00	.94
Flying Hours	.95	.92	.94	1.00

Based on the significant level of correlation, multicollinearity, an instance when two or more independent variables used in a model contribute redundant information, exists if more than one of the variables is included. Furthermore, these high correlations among mission-related variables and the number of major installations may obfuscate the impact of closing bases. Therefore, we expect that either major installations or one of the surrogate measures is the best explanatory variable.

Based on the identified variables and the available data, the proposed model relating the appropriation budgets to the independent variable, major installations or one of the mission level surrogate variables, is

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$$

where

y = appropriation for the respective budget

x_1 = fiscal year

x_2 = number of major installations or surrogate mission requirement variable

ε = error term

4.3. Final Results

For each of Air Force's appropriations, to include the overall total, the budgets were regressed on major installations. Subsequently, the appropriations were regressed with each of the surrogate measures—active duty Air Force members, number of aircraft, and number of flying hours—to determine which one provided the best fit; "best" defined as the highest coefficient of determination, or R^2 statistic. Finally, we compare the regression of the respective budgets based on major installations and the best regression based on surrogate mission-level variable to determine which model provides a better fit to the budget data.

It is important to note that variables with negative coefficients or those with a p-value of more than .05 were determined to be "statistically insignificant."

4.3.1. Operations and Maintenance Appropriation

We regressed the Operations and Maintenance (O&M) appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 4 and Figure 2.

Table 4. O&M Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.7346586
R Square	0.5397233
Adjusted R Square	0.5068463
Standard Error	2.312E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.05E+12	1.97E+11	1.07E-05
FY	533906490	97470776	7.53E-06
Major	176971606	31326628	4.72E-06

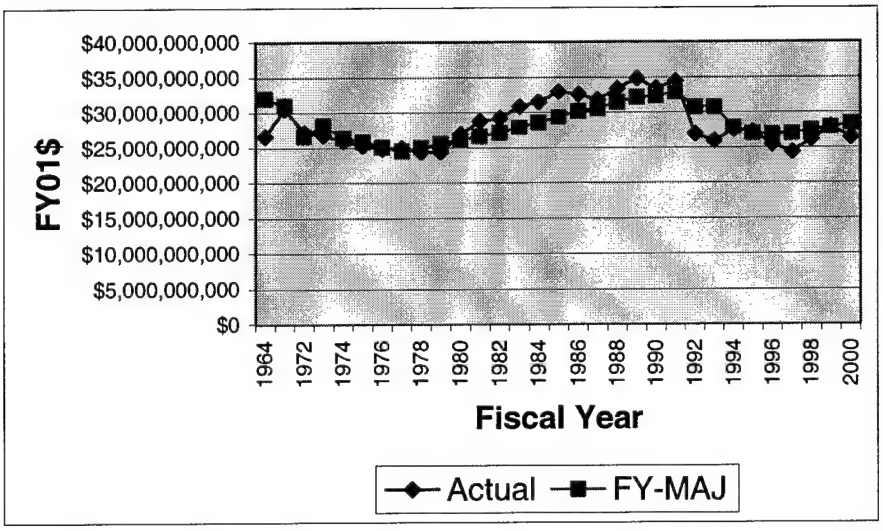


Figure 2. O&M Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 54.0 percent of the variability within the O&M budget. The coefficients indicate that each fiscal year the O&M budget increases by $533.9 million (in fiscal year 2001 dollars) and the average budget per major installation is $177.0 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources.

We also regressed the O&M appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 5 and Figure 3.

Table 5. O&M Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.7978287
R Square	0.6365306
Adjusted R Square	0.6105685
Standard Error	2.054E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.3E+12	1.95E+11	3.36E-07
FY	653766989	96607532	2.38E-07
ADAF	48986.641	7080.094	1.61E-07

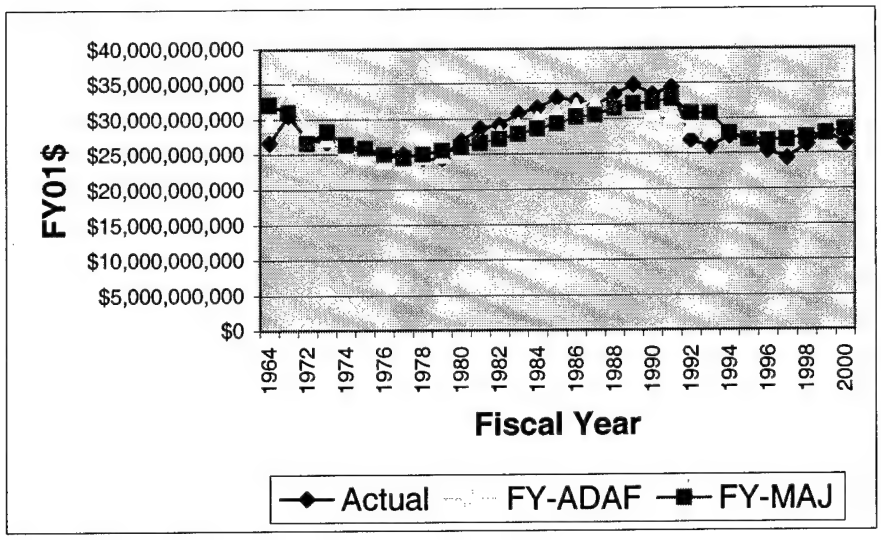


Figure 3. O&M Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 63.7 percent of the variability within the O&M budget. The coefficients indicate that each fiscal year the O&M budget increases by $653.8 million (in fiscal year 2001 dollars) and each Air Force member contributes an average of $49.0 thousand (in fiscal year 2001 dollars) to the budget.

The results illustrate a stronger correlation between the O&M budget and the number of active duty Air Force members when compared to the relation between the numbers of major installations. Furthermore, this analysis supports the idea that reducing the number of active duty Air Force members, as opposed to closing major installations, is the impetus for saving O&M expenses.

4.3.2. Military Construction Appropriation

We regressed the Military Construction (MILCON) appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 6 and Figure 4.

Table 6. MILCON Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.500899
R Square	0.2509
Adjusted R Square	0.197393
Standard Error	4.95E+08
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-5.7E+10	4.23E+10	0.191972
FY	28177578	20889770	0.188188
Major	16384385	6713869	0.021256

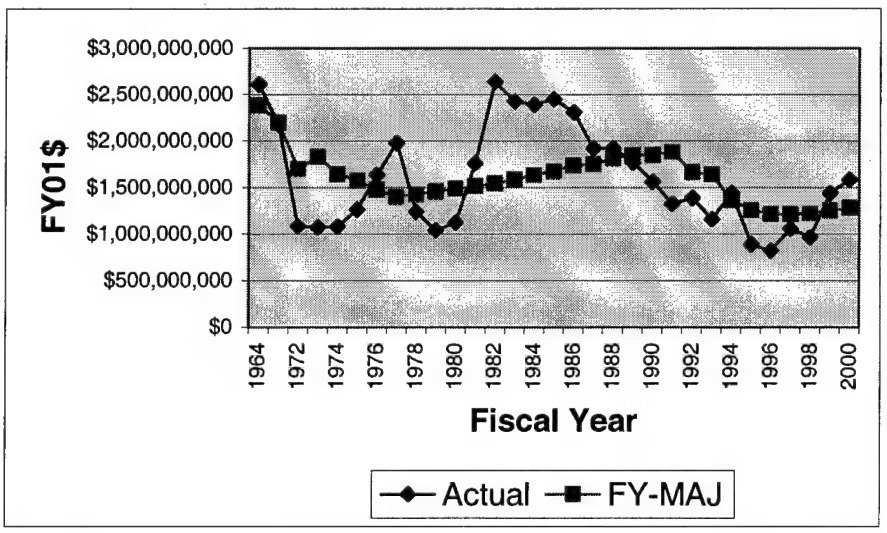


Figure 4. MILCON Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 25.1 percent of the variability within the MILCON budget. The coefficients indicate that each fiscal year the MILCON budget increases by $28.2 million (in fiscal year 2001 dollars) and the average budget per major installation is $16.4 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources. (Note: As indicated by the p-values for the intercept and fiscal year, this regression model is significantly insignificant; however, it is presented to compare with the results of the model using the surrogate measure.)

We also regressed the MILCON appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 7 and Figure 5:

Table 7. MILCON Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.607323
R Square	0.368841
Adjusted R Square	0.323758
Standard Error	4.55E+08
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1E+11	4.32E+10	0.023957
FY	51286519	21386785	0.023392
ADAF	5497.11	1567.377	0.001547

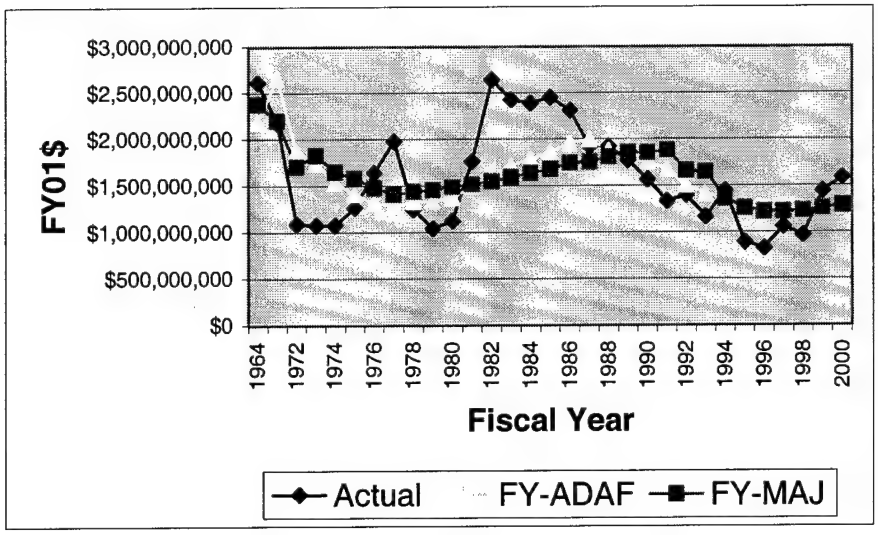


Figure 5. MILCON Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 36.9 percent of the variability within the MILCON budget. The coefficients indicate that each fiscal year the MILCON budget increases by $51.3 million (in fiscal year 2001 dollars) and each Air Force member contributes an average of $5.5 thousand (in fiscal year 2001 dollars) to the budget. Ultimately, this analysis supports the assumption that BRAC does not save MILCON expenses; reducing the number of active duty Air Force members does.

4.3.3. Military Personnel Appropriation

We regressed the Military Personnel (Mil Pers) appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 8 and Figure 6.

Table 8. Mil Pers Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.8929674
R Square	0.7973907
Adjusted R Square	0.7829186
Standard Error	2.313E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.02E+12	1.97E+11	1.7E-05
FY	509592314	97507316	1.49E-05
Major	274512024	31338371	1.64E-09

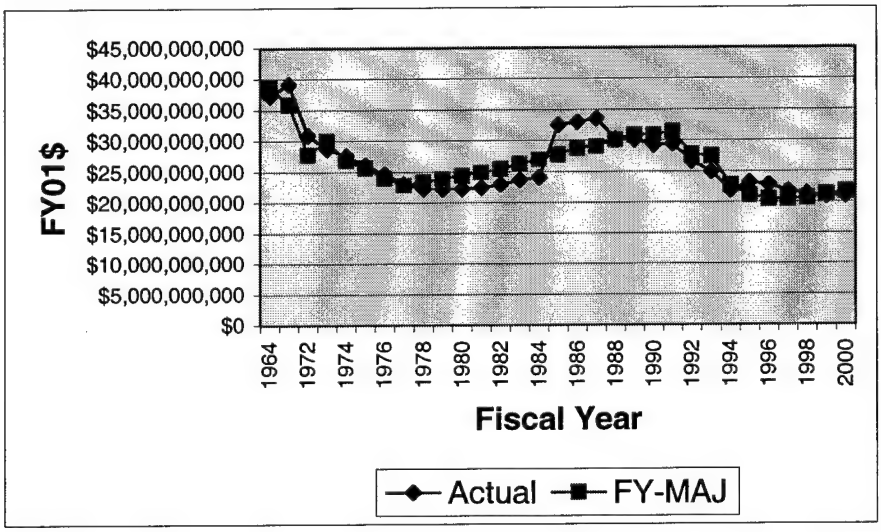


Figure 6. Mil Pers Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 79.7 percent of the variability within the Mil Pers budget. The coefficients indicate that each fiscal year the Mil Pers budget increases by $509.6 million (in fiscal year 2001 dollars) and the average budget per major installation is $274.5 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases would produce savings.

We also regressed the Mil Pers appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 9 and Figure 7.

Table 9. Mil Pers Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.9188878
R Square	0.8443548
Adjusted R Square	0.8332373
Standard Error	2.027E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.31E+12	1.93E+11	2.12E-07
FY	654598674	95320772	1.84E-07
ADAF	72710.012	6985.791	3.95E-11

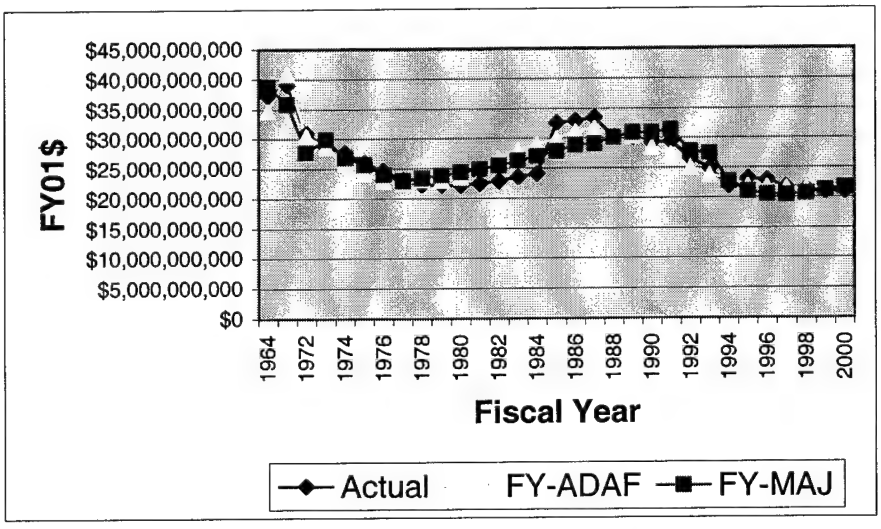


Figure 7. Mil Pers Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 84.4 percent of the variability within the Mil Pers budget. The coefficients indicate that each fiscal year the Mil Pers budget increases by $654.6 million (in fiscal year 2001 dollars) and each Air Force member contributes an average of $72.7 thousand (in fiscal year 2001 dollars) to the budget. Our analysis supports the premise that reducing the number of active duty Air Force members, as opposed to BRAC, saves Mil Pers expenses.

4.3.4. Military Family Housing Appropriation

We regressed the Military Family Housing appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 10 and Figure 8.

Table 10. Family Housing Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.909255
R Square	0.826744
Adjusted R Square	0.814369
Standard Error	1.73E+08
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.2E+11	1.48E+10	1.58E-08
FY	58270119	7313738	1.12E-08
Major	7885578	2350599	0.002295

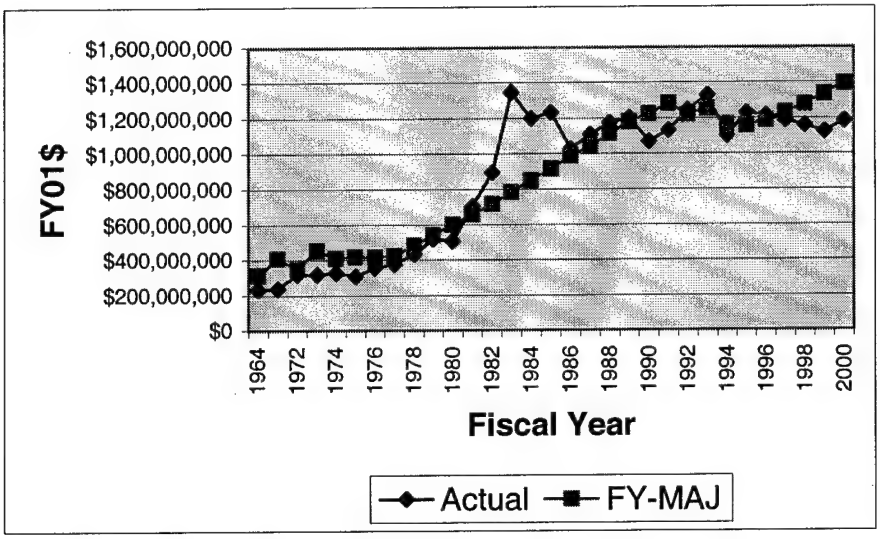


Figure 8. Family Housing Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 82.7 percent of the variability within the Family Housing budget. The coefficients indicate that each fiscal year the Family Housing budget increases by $58.3 million (in fiscal year 2001 dollars) and the average budget per major installation is $7.9 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources.

We also regressed the Family Housing appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 11 and Figure 9.

Table 11. Family Housing Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.9186667
R Square	0.8439486
Adjusted R Square	0.8328021
Standard Error	164631342
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.28E+11	1.57E+10	6.65E-09
FY	64321178	7741788	4.86E-09
ADAF	2239.6404	567.3739	0.000484

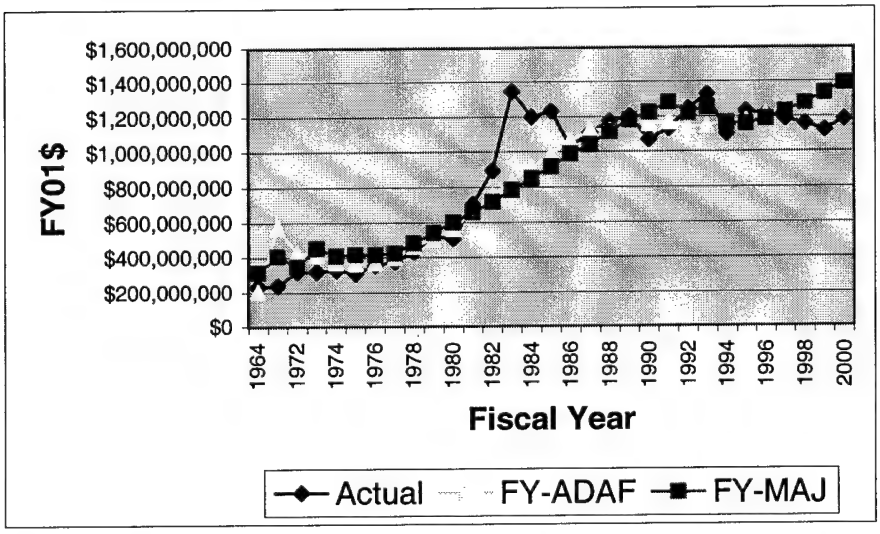


Figure 9. Family Housing Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 84.4 percent of the variability within the Family Housing budget. The coefficients indicate that each fiscal year the Family Housing budget increases by $64.3 million (in fiscal year 2001 dollars) and each Air Force member contributes an average of $2.2 thousand (in fiscal year 2001 dollars) to the budget. Ultimately, this analysis supports the theory that BRAC does not

save Family Housing expenses, reducing the number of active duty Air Force members does.

4.3.5. Research and Development Appropriation

We regressed the Research and Development (R&D) appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 12 and Figure 10.

Table 12. R&D Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.776318
R Square	0.60267
Adjusted R Square	0.57429
Standard Error	2.27E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.2E+12	1.93E+11	5.73E-07
FY	6.21E+08	95525092	4.77E-07
Major	1.84E+08	30701294	1.86E-06

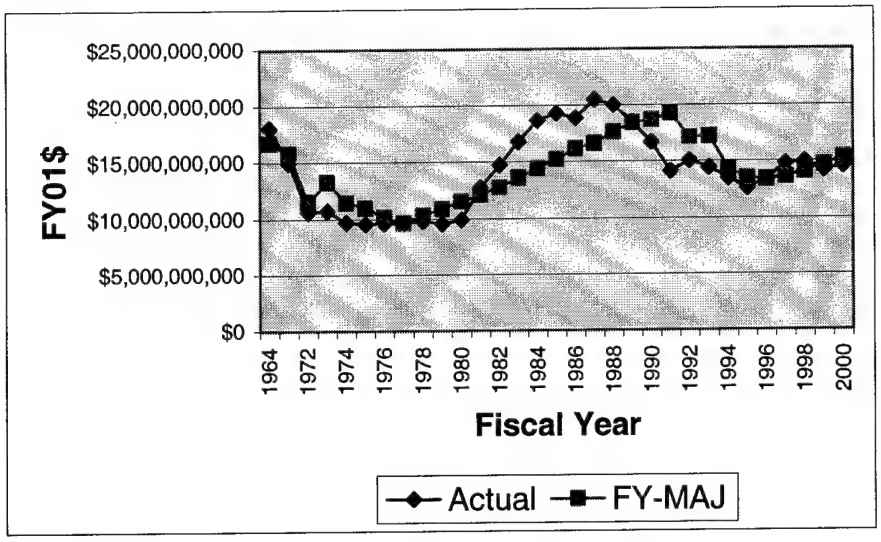


Figure 10. R&D Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 60.3 percent of the variability within the R&D budget. The coefficients indicate that each fiscal year the R&D budget increases by $621.3 million (in fiscal year 2001 dollars) and the average budget per major installation is $184.0 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources.

We also regressed the R&D appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 13 and Figure 11.

Table 13. R&D Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.865066
R Square	0.748339
Adjusted R Square	0.730364
Standard Error	1.8E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-1.5E+12	1.71E+11	8.66E-10
FY	7.73E+08	84793339	7.21E-10
ADAF	53067.07	6214.265	2.78E-09

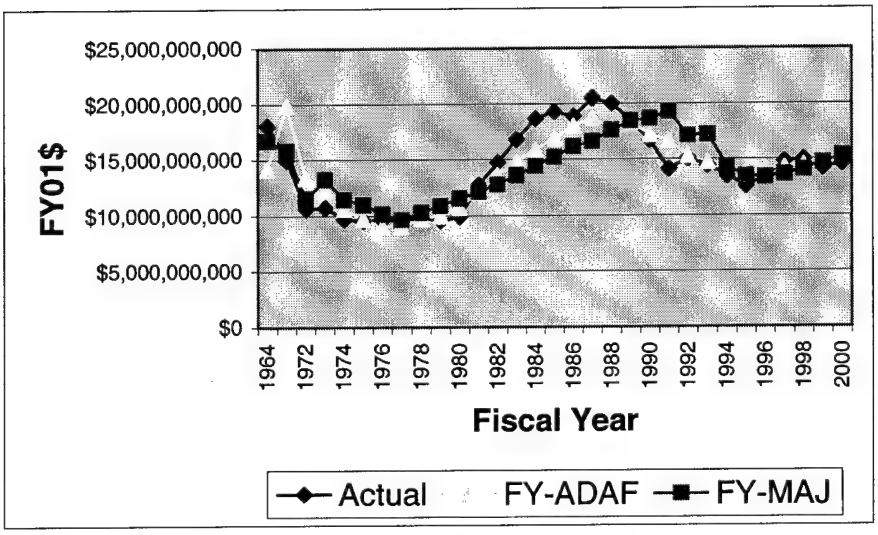


Figure 11. R&D Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 74.8 percent of the variability within the R&D budget. The coefficients indicate that each fiscal year the R&D budget increases by $772.6 million (in fiscal year 2001 dollars) and each Air Force member contributes an average of $53.1 thousand (in fiscal year 2001 dollars) to the budget. Consistent with the results from the other appropriations, this analysis supports

the idea that reducing the Air Force mission, as defined by the surrogate measure, saves R&D expenses rather than closing major installations.

4.3.6. Procurement Appropriation

We regressed the Procurement appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 14 and Figure 12.

Table 14. Procurement Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.5964457
R Square	0.3557474
Adjusted R Square	0.3097294
Standard Error	9.728E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-2.22E+12	8.3E+11	0.012372
FY	1.1E+09	4.1E+08	0.012141
Major	486120971	1.32E+08	0.000964

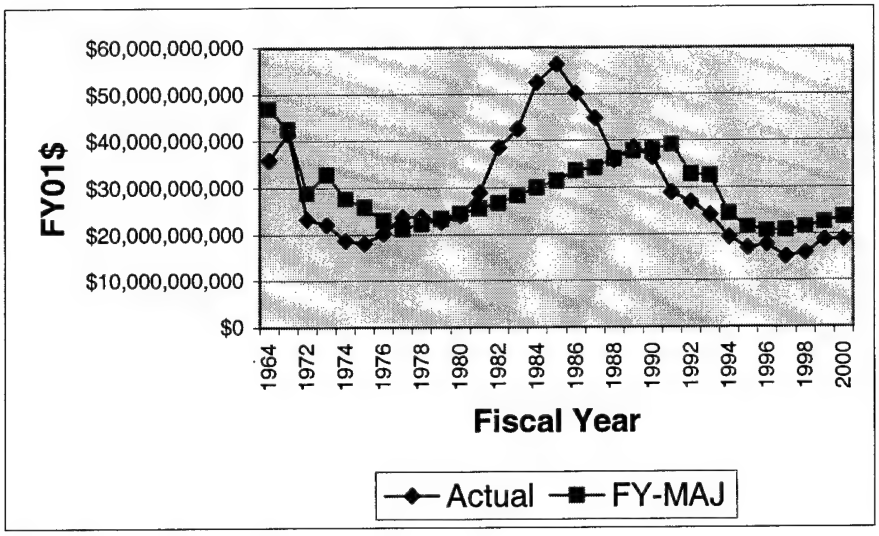


Figure 12. Procurement Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 35.6 percent of the variability within the Procurement budget. The coefficients indicate that each fiscal year the Procurement budget increases by $1.1 billion (in fiscal year 2001 dollars) and the average budget per major installation is $486.1 million (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources.

We also regressed the Procurement appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 15 and Figure 13.

Table 15. Procurement Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.75049717
R Square	0.56324601
Adjusted R Square	0.53204929
Standard Error	8009329955
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-3.513E+12	7.62E+11	8E-05
FY	1739855078	3.77E+08	7.85E-05
ADAF	159440.649	27602.79	3.35E-06

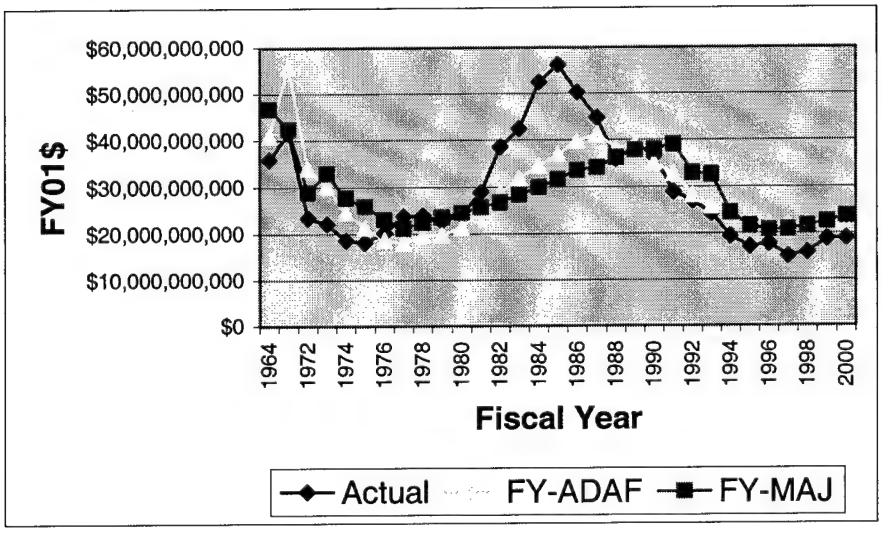


Figure 13. Procurement Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 56.3 percent of the variability within the Procurement budget. The coefficients indicate that each fiscal year the Procurement budget increases by $1.7 billion (in fiscal year 2001 dollars) and each Air Force member contributes an average of $159.4 thousand (in fiscal year 2001 dollars)

to the budget. This analysis supports our claim that BRAC does not save Procurement expenses, reducing the Air Force mission does.

4.3.7. Total Air Force Appropriation

We regressed the total Air Force appropriation budget with fiscal years and major installations. The Excel regression routine produced the results shown in Table 16 and Figure 14.

Table 16. Total Air Force Regression Results (FY-Major Installations)

Regression Statistics	
Multiple R	0.739483
R Square	0.546835
Adjusted R Square	0.514466
Standard Error	1.32E+10
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-6.2E+12	1.13E+12	7.43E-06
FY	3.1E+09	5.57E+08	6.02E-06
Major	1.03E+09	1.79E+08	3.81E-06

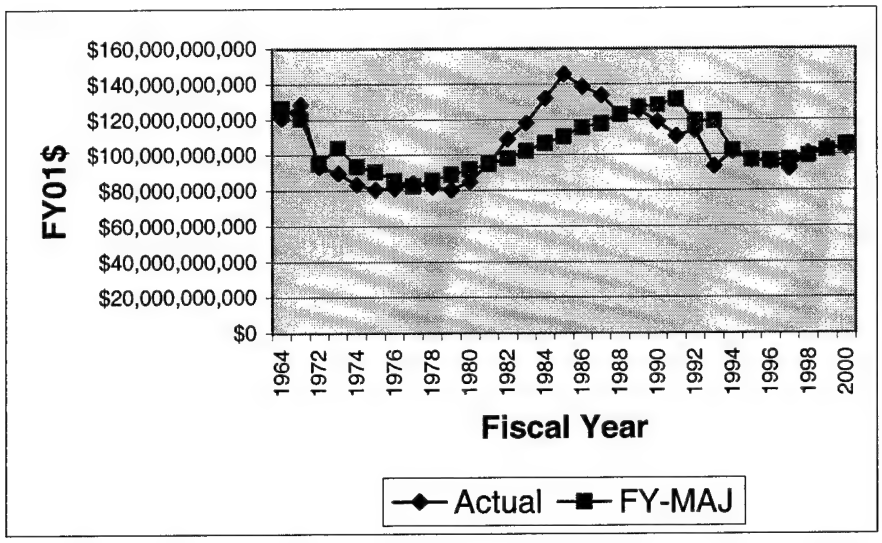


Figure 14. Total Air Force Appropriation regressed by FY and Major Installations

As indicated by the R^2 statistic, this model accounts for 54.9 percent of the variability within the total Air Force budget. The coefficients indicate that each fiscal year the Total budget increases by $3.1 billion (in fiscal year 2001 dollars) and the average budget per major installation is $1.0 billion (in fiscal year 2001 dollars). Based on these results, an argument could be made that closing bases saves fiscal resources.

We also regressed the total Air Force appropriation budget with fiscal years and all of the surrogate measures for the Air Force mission—active duty Air Force members provided the best fit as indicated by the R^2 statistic. The Excel regression routine produced the results shown in Table 17 and Figure 15.

Table 17. Total Air Force Regression Results (FY-ADAF)

Regression Statistics	
Multiple R	0.898113
R Square	0.806607
Adjusted R Square	0.792793
Standard Error	8.64E+09
Observations	31

	Coefficients	Standard Error	P-value
Intercept	-8.5E+12	8.21E+11	5.03E-11
FY	4.22E+09	4.06E+08	4.01E-11
ADAF	318481	29761.37	2.11E-11

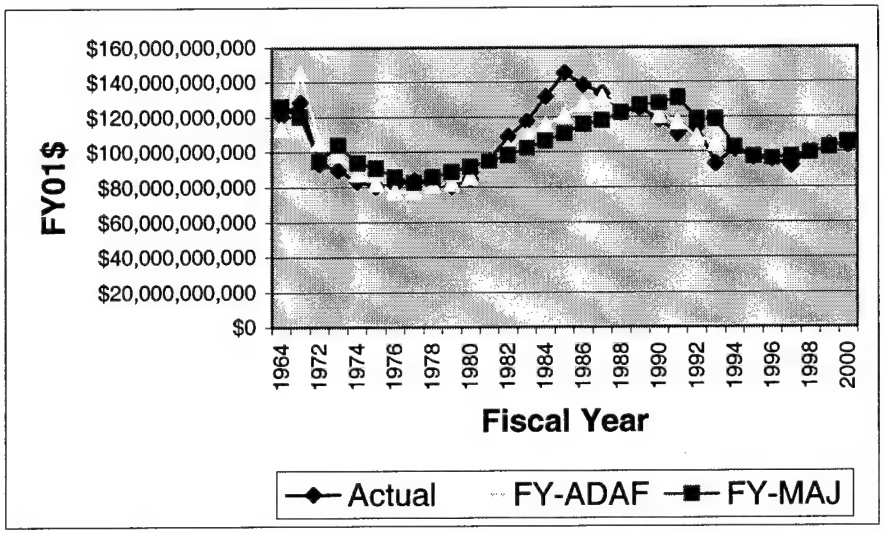


Figure 15. Total Air Force Appropriation regressed by FY and ADAF

As indicated by the R^2 statistic, this model accounts for 80.7 percent of the variability within the total Air Force budget. The coefficients indicate that each fiscal year the Total budget increases by $4.2 billion (in fiscal year 2001 dollars) and each Air Force member contributes an average of $318.5 thousand (in fiscal year 2001 dollars) to the budget. Ultimately, this analysis supports the theory that curtailing the Air Force mission is the driving factor behind reducing the budget rather than BRAC.

4.4. Summary

Based on the results of the regression models, summarized in Table 18 and presented in detail in Appendices D-J, there is significant evidence that the mission requirement surrogate measure, active duty Air Force members, serves as a better explanatory variable for the respective appropriation budgets and the overall Air Force budget when compared to the number of major installations. This conclusion would refute the idea that closing bases, in and of themselves, is the impetus for generating substantial savings.

Table 18. Summary of Regression Analyses

	MAJOR INSTALLATION MODEL			
	Coefficients (in millions)			
Appropriation	Intercept	FY	Major	R^2
O&M	-$1,054,762.0	$533.9	$177.0	54.0%
MILCON	-$56,500.1	$28.2	$16.4	25.1%
Mil Pers	-$1,021,363.9	$509.6	$274.5	79.7%
Family Housing	-$115,830.9	$58.3	$7.9	82.7%
R&D	-$1,243,340.5	$621.3	$184.0	60.3%
Procurement	-$2,218,359.4	$1,099.9	$486.1	35.6%
Total	-$6,181,316.8	$3,098.8	$1,026.2	54.7%

	ACTIVE DUTY AIR FORCE MODEL			
	Coefficients (in millions)			
Appropriation	Intercept	FY	ADAF	R^2
O&M	-$1,296,390.0	$653.8	$0.0490	63.7%
MILCON	-$103,245.2	$51.3	$0.0055	36.9%
Mil Pers	-$1,313,140.2	$654.6	$0.0727	84.4%
Family Housing	-$128,038.8	$64.3	$0.0022	84.4%
R&D	-$1,548,604.6	$772.6	$0.0531	74.8%
Procurement	-$3,512,591.0	$1,739.9	$0.1594	56.3%
Total	-$8,454,866.8	$4,223.8	$0.3185	80.7%

We further deduce that substantial savings can be generated when the Air Force reduces its mission, and the reduction in mission requirements promotes reducing the number of active duty Air Force members; we do not expect transferring requirements to civilian employees or contractors would constitute a reduction in the mission. This reduction in the number of active duty Air Force members due to a scaled-down mission would support the argument for additional rounds of BRAC. We test this supposition by regressing major installations with the number of active duty Air Force members. The Excel regression routine produced the results shown in Table 19 and Figure 16; the detailed results are presented in Appendix K.

Table 19. ADAF and Major Installation Regression Results

Regression Statistics	
Multiple R	0.968159
R Square	0.937333
Adjusted R Square	0.903999
Standard Error	7.506573
Observations	31

	Coefficients	Standard Error	P-value
Intercept	0	#N/A	#N/A
ADAF	0.000238	2.36E-06	1.64E-39

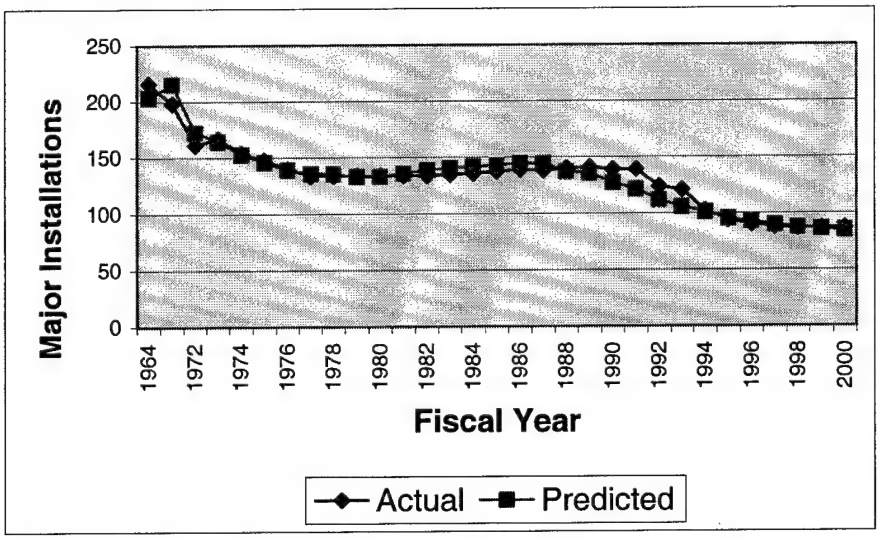


Figure 16. Major Installations regressed by ADAF

As indicated by the R^2 statistic, this model accounts for 93.7 percent of the variability within the number of major installations. The coefficient indicates that each active duty Air Force member accounts for .000238 of a major installation—in other words, approximately 4202 active duty Air Force members would make up one major installation. We can conclude that a reduction in the mission resulting in the elimination of approximately 4202 active duty Air Force members would support the closure of one major installation.

The Air Force decreased from 576,446 active duty members in fiscal year 1988 to 357,777 airmen in fiscal year 2000. This reduction of 218,669 members constitutes a 37.9 percent decrease. During this same period, the number of major installations decreased from 140 to 87, which is also a 37.9 percent reduction. Under the assumption that the number of active duty Air Force members determines the number of major installations, the Air Force has already closed the appropriate number of major installations.

5. Conclusions

5.1. Summary of Research

We analyzed the savings resulting from the previous four rounds of BRAC in terms of their affect on each of the budget appropriations. For each appropriation, while the number of major installations initially appears to be a significant determinant in explaining the change in the budget, the number of bases becomes insignificant if a surrogate for Air Force mission requirements is included as the explanatory variable. We tested three surrogate measures for mission requirements: number of flying hours, number of aircraft, and number of active duty personnel. In each case, we found the number of active duty Air Force members to be a better predictor of the budget level than the regression model that included the number of major installations. We conclude that mission requirements are a better indicator of the required funding than the number of major installations.

Additionally, we analyzed the statistical relationship between the number of major installations and the number of active duty Air Force members. We found that the number of active duty Air Force members is an excellent predictor for the number of major installations—on average, 4,202 active duty Air Force members would equate to one major installation.

5.2. Suggestions for Further Research

We present four topics for potential future investigation.

5.2.1. Effects of Other Variables

Subsequent research on the costs and savings derived from BRAC may consider other dependent variables. Some additional potential influences may be the effects of flying vs. non-flying wings (particularly space oriented units), major vs. minor installations, the number of aircraft by type (fighter, bomber, cargo), and the number of Guard and Reserve Personnel. These mission-related variables, or a combination of them, may provide better indications of the Air Force mission requirements.

5.2.2. Impact of Competitive Sourcing

> The 1999 FYDP was the first to reflect savings from DoD's Defense Reform Initiative (DRI). The intention of the DRI was to change how DoD does business internally and with the private sector. The DRI has four basic tenets: (1) reduce excess infrastructure and redundancies, (2) adopt modern business practices to achieve world class standards of performance and continue to reform the acquisition process, (3) streamline organizations to remove redundancies and maximize synergy, and (4) expand the use of competition between the public and private sectors to improve performance and reduce the cost of DoD business and support activities. Quantifiable long-term savings to pay for future modernization have been estimated for only two initiatives: public/private competitions (competitive sourcing) and base realignment and closures [11:32-33].

It is conceivable that as DoD exercises the option to competitively source traditionally organic functions, and those functions are carried out at the contractors' facilities, military and civilian positions may be eliminated and provide additional opportunities to close military installations.

5.2.3. Impact of Interservice BRAC Actions

As noted by the SAF/FMC report, savings attributed to Air Force personnel cuts averaged 86.7 percent of the total BRAC savings—the ratio increased from 78 percent in BRAC 88 to 99 percent in BRAC 95 [1:7]. "By contrast actual dollar amounts for non-personnel savings in each BRAC round decline from a high of $403 million in BRAC 91

to just $7 million in BRAC 95. Should relatively large personnel savings of the past not reoccur in the future, then it would remain to be seen how the Air Force would achieve necessary savings to offset likely closure costs" [1:7]. The report further argues "future rounds of BRAC are more likely to be concentrated in areas other than operational and training activities, and may be less likely to be accompanied by significant personnel reductions even in support areas" [1:8].

In line with the SAF/FMC report, the GAO believes future rounds of BRAC will focus on non-operational installations and savings will have to be attained in the absence of *intraservice* personnel cuts. In its 1997 compilation of lessons learned from prior rounds, the GAO emphasizes the need for *interservice* BRAC actions in order realize significant savings from the elimination of any additional excess infrastructure:

> Despite these recent BRAC rounds, DoD continues to maintain large amounts of excess infrastructure, especially in its support functions, such as maintenance depots, research and development laboratories, and test and evaluation centers. Each service maintains its own facilities and capabilities for performing many common support functions and, as a result, DoD has overlapping, redundant, and underutilized infrastructure. DoD has taken some steps to demolish unneeded buildings on various operational and support bases; consolidate certain functions; privatize, outsource, and reengineer certain workloads; and encourage interservicing agreements—however, these are not expected to offset the need for additional actions. At the same time, DoD officials recognize that significant additional reductions in excess infrastructure requirements in common support areas could come from consolidating workloads and restructuring functions on a cross-service basis, something that has not been accomplished to any great extent in prior BRAC rounds. [97-151:3]

At the very least, consideration needs to be given to the development of a joint service position outlining how the services will determine the installations to close and realign, and the development of a uniform methodology to estimate costs and savings.

5.2.4. Facility Thinning

Since the draw down in the 1990s, there has been inverse effect between the number of people on active duty and the amount of space allocated to per capita within military units. As the size of the military has decreased, units have spread out and now consume more space then previously used.

Facility thinning is an initiative to minimize the buildings supported only to those necessary to accomplish the mission. This effort would identify the amount of space needed by each unit based on its mission requirements and propose a strategy to eliminate excess capacity. This would prevent units from sprawling out into vacant spaces that they do not really need and could result in savings by reducing the financial outlay to maintain unnecessary buildings.

Appendix A: Master Facilities Closure List

This is a listing of the bases recommended and approved for closure as a result of decisions by the various Base Realignment and Closure Commissions.

1988 Commission
16 Major Closures
George AFB, CA
Mather AFB, CA
Norton AFB, CA
Presidio of San Francisco, CA
Chanute AFB, IL
Fort Sheridan, IL
Jefferson Proving Ground, IN
Lexington Army Depot, KY
Naval Station Lake Charles, LA
Army Material Tech Lab, MA
Pease AFB, NH
Naval Station Brooklyn, NY
Philadelphia Naval Hospital, PA
Naval Station, Galveston, TX
Fort Douglas, UT
Cameron Station, VA

1991 Commission
26 Major Closures
Eaker AFB, AR
Williams AFB, AZ
Castle AFB, CA
Fort Ord, CA
Hunters Point Annex, CA
Moffett NAS, CA
Naval Station Long Beach, CA
NAV ElecSysEngrCtr, San Diego, CA
Sacramento Army Depot, CA
Tustin MCAS, CA
Lowry AFB, CO
Fort Benjamin Harrison, IN
Grissom AFB, IN
England AFB, LA
Fort Devens, MA
Loring AFB, ME
Wurtsmith AFB, MI
Richards-Gebaur ARS, MO
Rickenbacker AGB, OH
Naval Station Philadelphia, PA
Philadelphia Naval Shipyard, PA
Myrtle Beach AFB, SC
Bergstrom AFB, TX
(Active Component Only)
Carswell AFB, TX
Chase Field NAS, TX
Naval Station Puget Sound, WA

1993 Commission
28 Major Closures
Naval Station Mobile, AL
Mare Island Naval Shipyard, CA
MCAS El Toro, CA
Naval Airs Station Alameda, CA
Naval Aviation Depot Alameda, CA
Naval Hospital Oakland, CA
Naval Station Treasure Island, CA
Naval Training Center San Diego, CA
Naval Air Station Cecil Field, FL
Naval Aviation Depot Pensacola, FL
Homestead AFB, FL
Naval Training Center Orlando, FL
Naval Air Station Agana, Guam
Naval Air Station Barbers Point, HI
Naval Air Station Glenview, IL
O'Hare IAP ARS, IL
NESEC, St. Inigoes, MD
K.I. Sawyer AFB, MI
Naval Station Staten Island, NY
Plattsburgh AFB, NY
Gentile Air Force Station, OH (DESC)
Newark AFB, OH
Defense Per. Support Center, PA
Charleston Naval Shipyard, SC
Naval Station Charleston, SC
Naval Air Station Dallas, TX
Naval Aviation Depot Norfolk, VA
Vint Hill Farms, VA

1995 Commission
27 Major Closures
Naval Air Facility, Adak, AK
Fort McClellan, AL
Fort Chaffee, AR
Fleet Industrial SU Center, Oakland, CA
Naval Shipyard, Long Beach, CA
McClellan AFB, CA
Oakland Army Base, CA
Ontario IAP Air Guard Station, CA
Fitzsimoms Army Medical Center, CO
Ship Repair Facility, Guam
Savanna Army Depot Activitym, IL
Naval Air Warfare Center, Aircraft Division, Indianapolis, IN
NAWC, Crane Division Detachment, Louisville, KY
Naval Air Station, South Weymoth, MA
Fort Holabird, MD
Fort Ritchie, MD
NSWC, Dahlgren Division Detachment, White Oak, MD
Bayonne Military Ocean Terminal, NJ
Roslyn Air Guard Station, NY
Seneca Army Depot, NY
Fort Indiantown Gap, PA
NAWC, Aircraft Div., Warminster, PA
Defense Dist. Depot Memphis, TN
Bergstrom Air Reserve Base, TX
Resse AFB, TX
Defense Distribution Depot Ogden, UT
Fort Pickett, VA

Source: http://www.afbca.hq.af.mil/

Appendix B: Reclassification of Air Force Installations

The May 1988 Almanac Edition of the Air Force Magazine provides an overview of the reclassification of Air Force installations:

> During 1986, the Air Force undertook a major project to redefine and categorize all Air Force properties and activities to reflect more accurately actual installation posture. The new definitions reclassified all Air Force activities into one of four categories: major installations, minor installations, support sites, and other activities. For an installation to be categorized as "major," it must be operated by an active, Guard, or Reserve unit of group size or larger and have all the organic support to accomplish the unit's mission. Minor installations are facilities operated by active, Guard, or Reserve unit of at least squadron size that do not satisfy all of the criteria for a major installation. Examples of minor installations are Guard and Reserve flying operations that are located at civilian-owned airports. A support site is a detached piece of real property that provides general support to the Air Force mission as opposed to supporting a particular installation. Examples of support sites are missile tracking sites, radar bomb-scoring sites, and radio relay sites. The fourth classification category, other activities, includes Air Force unites that have little or not real-property accountability over the real estate that they occupy. Examples include units that are located on installations belonging to other services or in leased office space that supports recruiting detachments, Civil Air Patrol, etc. The new Air Force classification system is designed to describe accurately the Air Force installation posture. Previously, the Air Force reported more than 2,800 installations worldwide. In reality, the number of independent installations totals only 262: 140 major and 122 minor [6].

Appendix C: Regression Database

FY	MILPERS	O&M	Procurement	RDT&E
1964	$37,215,906,000	$26,647,748,000	$35,886,820,000	$18,019,293,000
1968	$39,092,780,000	$30,502,299,000	$41,492,628,000	$14,969,920,000
1972	$30,921,673,000	$27,163,356,000	$23,363,788,000	$10,589,253,000
1973	$28,755,657,000	$26,745,299,000	$22,115,232,000	$10,707,981,000
1974	$27,610,967,000	$25,962,312,000	$18,637,627,000	$9,715,385,000
1975	$26,015,162,000	$25,248,013,000	$18,150,296,000	$9,536,990,000
1976	$24,634,324,000	$24,907,580,000	$20,201,298,000	$9,599,185,000
1977	$23,043,264,000	$24,971,361,000	$23,749,846,000	$9,661,179,000
1978	$22,243,234,000	$24,397,199,000	$23,840,116,000	$9,808,748,000
1979	$22,224,196,000	$24,368,006,000	$22,730,159,000	$9,550,275,000
1980	$22,220,006,000	$26,925,996,000	$24,082,380,000	$9,873,948,000
1981	$22,453,190,000	$28,712,300,000	$28,959,506,000	$12,707,086,000
1982	$22,936,378,000	$29,150,632,000	$38,539,190,000	$14,731,775,000
1983	$23,585,890,000	$30,853,563,000	$42,473,697,000	$16,760,822,000
1984	$24,064,549,000	$31,514,048,000	$52,466,041,000	$18,642,135,000
1985	$32,578,759,000	$32,929,850,000	$56,259,026,000	$19,264,253,000
1986	$32,970,096,000	$32,578,158,000	$50,197,043,000	$18,819,378,000
1987	$33,448,954,000	$31,827,945,000	$44,735,721,000	$20,451,616,000
1988	$30,184,120,000	$33,388,346,000	$35,876,788,000	$19,973,883,000
1989	$30,143,906,000	$34,823,905,000	$38,483,771,000	$18,462,452,000
1990	$29,227,316,000	$33,410,104,000	$36,444,036,000	$16,701,653,000
1991	$29,404,567,000	$34,439,792,000	$28,919,019,000	$14,102,189,000
1992	$26,625,831,000	$26,883,728,000	$26,941,851,000	$15,047,677,000
1993	$24,933,189,000	$25,942,830,000	$24,168,594,000	$14,448,136,000
1994	$21,909,736,000	$27,484,712,000	$19,396,263,000	$13,497,356,000
1995	$23,171,517,000	$27,196,084,000	$17,105,493,000	$12,626,141,000
1996	$22,861,516,000	$25,388,936,000	$17,823,062,000	$13,365,262,000
1997	$21,766,355,000	$24,352,930,000	$15,143,239,000	$14,765,572,000
1998	$21,409,451,000	$26,198,275,000	$15,930,479,000	$14,942,030,000
1999	$20,972,712,000	$27,942,990,000	$18,812,967,000	$14,179,402,000
2000	$21,064,642,000	$26,357,344,000	$18,933,160,000	$14,567,219,000

Notes:
(1) Shaded cell indicates mathematical interpolation was used to estimate the values.
(2) Dollars in constant FY2001

FY	MILCON	Fam. Housing	Total
1964	$2,610,949,000	$232,613,000	$120,613,329,000
1968	$2,179,450,000	$239,052,000	$128,476,129,000
1972	$1,082,510,000	$318,279,000	$93,438,859,000
1973	$1,072,636,000	$317,769,000	$89,714,574,000
1974	$1,076,230,000	$327,608,000	$83,330,129,000
1975	$1,260,468,000	$308,772,000	$80,519,701,000
1976	$1,637,654,000	$355,962,000	$81,351,003,000
1977	$1,976,327,000	$376,271,000	$83,837,048,000
1978	$1,240,043,000	$431,718,000	$81,995,658,000
1979	$1,036,763,000	$518,784,000	$80,454,983,000
1980	$1,121,568,000	$507,733,000	$84,731,631,000
1981	$1,760,855,000	$702,317,000	$95,323,554,000
1982	$2,640,790,000	$893,810,000	$108,971,375,000
1983	$2,428,104,000	$1,345,201,000	$117,608,877,000
1984	$2,392,758,000	$1,199,180,000	$131,567,436,000
1985	$2,450,324,000	$1,234,204,000	$145,265,009,000
1986	$2,307,375,000	$1,029,150,000	$138,296,721,000
1987	$1,921,362,000	$1,107,451,000	$133,633,029,000
1988	$1,922,176,000	$1,175,980,000	$122,747,300,000
1989	$1,771,608,000	$1,203,594,000	$125,076,136,000
1990	$1,561,604,000	$1,069,297,000	$118,525,110,000
1991	$1,326,286,000	$1,132,151,000	$110,268,904,000
1992	$1,390,732,000	$1,244,600,000	$113,720,918,000
1993	$1,159,157,000	$1,328,795,000	$93,290,579,000
1994	$1,441,759,000	$1,099,995,000	$101,606,758,000
1995	$889,208,000	$1,228,563,000	$96,580,285,000
1996	$821,654,000	$1,213,935,000	$95,904,943,000
1997	$1,054,673,000	$1,187,609,000	$92,181,565,000
1998	$961,763,000	$1,158,383,000	$100,805,618,000
1999	$1,441,145,000	$1,121,585,000	$104,039,573,000
2000	$1,583,921,000	$1,183,191,000	$103,333,525,000

FY	Major	ADAF	# Aircraft	Flying Hours
1964	216	855,802	15,380	6,662
1968	198	904,759	15,327	7,697
1972	161	725,635	13,498	5,102
1973	167	690,999	12,910	4,454
1974	154	643,795	12,132	3,805
1975	148	612,551	11,196	3,477
1976	140	585,207	9,287	3,149
1977	134	570,479	9,256	3,167
1978	134	569,491	9,138	3,103
1979	134	559,450	9,037	3,208
1980	134	557,969	9,069	3,125
1981	134	570,302	9,180	3,201
1982	134	582,845	9,213	3,341
1983	135	592,044	9,355	3,389
1984	136	597,125	9,401	3,422
1985	137	601,515	9,443	3,477
1986	139	608,199	9,591	3,555
1987	138	607,035	9,447	3,463
1988	140	576,446	9,416	3,340
1989	141	570,880	9,279	3,412
1990	139	535,233	9,032	3,366
1991	139	510,432	8,510	3,166
1992	124	470,315	7,640	2,790
1993	121	444,351	7,182	2,584
1994	102	426,327	6,815	2,317
1995	94	400,409	6,633	2,253
1996	90	389,001	6,294	2,181
1997	88	377,385	6,330	2,205
1998	87	367,470	6,228	2,154
1999	87	360,590	6,203	2,132
2000	87	357,777	6,178	2,110

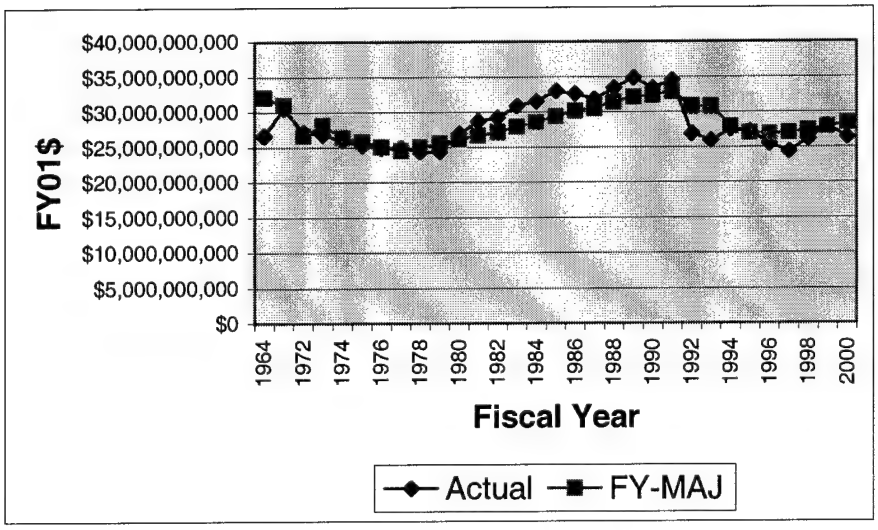
Notes:
(1) Shaded cell indicates mathematical interpolation was used to estimate the values.
(2) Dollars in constant FY2001
(3) "Major" is the number of major Air Force installations
(4) "ADAF" is the number of active duty Air Force members
(5) "# Aircraft" is the number of Air Force aircraft
(6) "Flying Hours" is the number of flying hours flown each fiscal year

Appendix D: Operations & Maintenance Regression Data

Regression Statistics	
Multiple R	0.7346586
R Square	0.5397233
Adjusted R Square	0.5068463
Standard Error	2.312E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	1.75E+20	8.77E+19	16.41648	1.92E-05
Residual	28	1.5E+20	5.34E+18		
Total	30	3.25E+20			

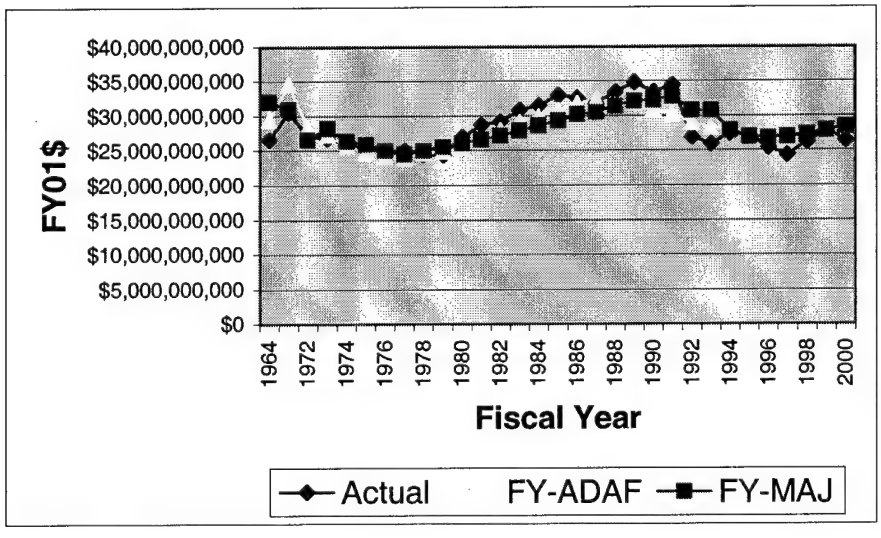
	Coefficients	Standard Error	P-value
Intercept	-1.05E+12	1.97E+11	1.07E-05
FY	533906490	97470776	7.53E-06
Major	176971606	31326628	4.72E-06



Regression Statistics	
Multiple R	0.7978287
R Square	0.6365306
Adjusted R Square	0.6105685
Standard Error	2.054E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2.07E+20	1.03E+20	24.51769	7.02E-07
Residual	28	1.18E+20	4.22E+18		
Total	30	3.25E+20			

	Coefficients	Standard Error	P-value
Intercept	-1.3E+12	1.95E+11	3.36E-07
FY	653766989	96607532	2.38E-07
ADAF	48986.641	7080.094	1.61E-07



FY	Actual	FY-ADAF	FY-MAJ
1964	$26,647,748,000	$29,531,194,990	$32,056,203,398
1968	$30,502,299,000	$34,544,501,931	$31,006,340,443
1972	$27,163,356,000	$28,384,886,793	$26,594,016,964
1973	$26,745,299,000	$27,341,952,481	$28,189,753,094
1974	$25,962,312,000	$25,683,354,066	$26,423,028,700
1975	$25,248,013,000	$24,806,582,441	$25,895,105,551
1976	$24,907,580,000	$24,120,858,716	$25,013,239,190
1977	$24,971,361,000	$24,053,150,456	$24,485,316,041
1978	$24,397,199,000	$24,658,518,643	$25,019,222,532
1979	$24,368,006,000	$24,820,410,769	$25,553,129,022
1980	$26,925,996,000	$25,401,628,542	$26,087,035,512
1981	$28,712,300,000	$26,659,547,774	$26,620,942,003
1982	$29,150,632,000	$27,927,754,202	$27,154,848,493
1983	$30,853,563,000	$29,032,149,301	$27,865,726,590
1984	$31,514,048,000	$29,934,817,413	$28,576,604,687
1985	$32,929,850,000	$30,803,635,756	$29,287,482,783
1986	$32,578,158,000	$31,784,829,454	$30,175,332,487
1987	$31,827,945,000	$32,381,575,992	$30,532,267,371
1988	$33,388,346,000	$31,536,890,617	$31,420,117,074
1989	$34,823,905,000	$31,917,997,962	$32,130,995,171
1990	$33,410,104,000	$30,825,538,157	$32,310,958,448
1991	$34,439,792,000	$30,264,387,460	$32,844,864,939
1992	$26,883,728,000	$28,952,957,370	$30,724,197,332
1993	$25,942,830,000	$28,334,835,210	$30,727,189,003
1994	$27,484,712,000	$28,105,666,980	$27,898,634,970
1995	$27,196,084,000	$27,489,798,206	$27,016,768,608
1996	$25,388,936,000	$27,584,725,593	$26,842,788,673
1997	$24,352,930,000	$27,669,463,759	$27,022,751,950
1998	$26,198,275,000	$27,837,528,202	$27,379,686,834
1999	$27,942,990,000	$28,154,267,100	$27,913,593,324
2000	$26,357,344,000	$28,670,234,667	$28,447,499,815

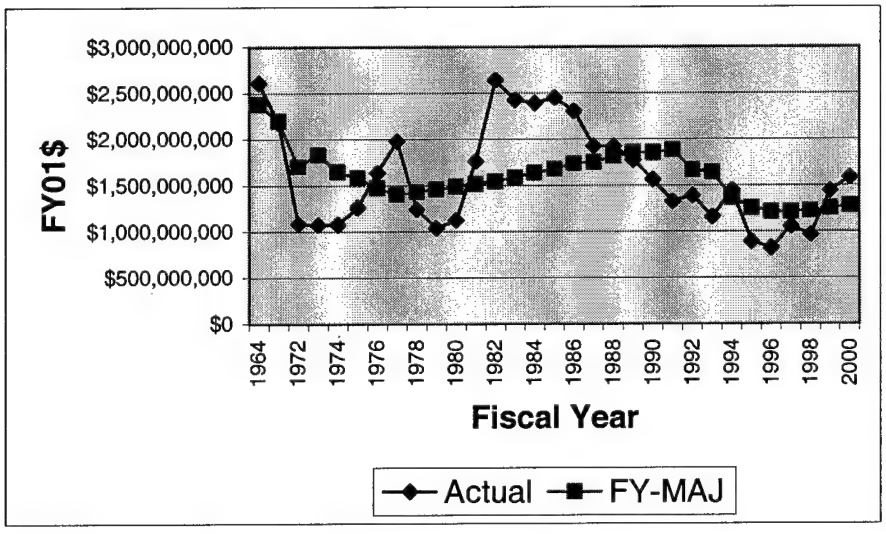
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix E: Military Construction Regression Data

Regression Statistics	
Multiple R	0.500899
R Square	0.2509
Adjusted R Square	0.197393
Standard Error	4.95E+08
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2.3E+18	1.15E+18	4.689097	0.017521
Residual	28	6.87E+18	2.45E+17		
Total	30	9.18E+18			

	Coefficients	Standard Error	P-value
Intercept	-5.7E+10	4.23E+10	0.191972
FY	28177578	20889770	0.188188
Major	16384385	6713869	0.021256

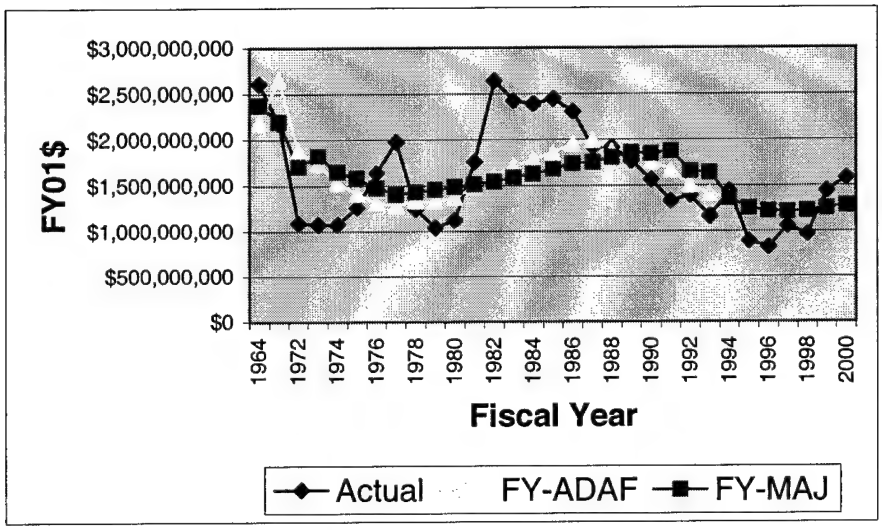


Note: As indicated by the p-values for the intercept and fiscal year, this regression model is significantly insignificant; however, it is presented to compare with the results of the model using the surrogate measure.

Regression Statistics	
Multiple R	0.607323
R Square	0.368841
Adjusted R Square	0.323758
Standard Error	4.55E+08
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	3.38E+18	1.69E+18	8.181402	0.001592
Residual	28	5.79E+18	2.07E+17		
Total	30	9.18E+18			

	Coefficients	Standard Error	P-value
Intercept	-1E+11	4.32E+10	0.023957
FY	51286519	21386785	0.023392
ADAF	5497.11	1567.377	0.001547



FY	Actual	FY-ADAF	FY-MAJ
1964	$2,610,949,000	$2,185,911,397	$2,379,648,343
1968	$2,179,450,000	$2,660,179,510	$2,197,439,719
1972	$1,082,510,000	$1,880,661,165	$1,703,927,775
1973	$1,072,636,000	$1,741,549,765	$1,830,411,665
1974	$1,076,230,000	$1,533,350,680	$1,645,592,234
1975	$1,260,468,000	$1,412,885,479	$1,575,463,500
1976	$1,637,654,000	$1,313,859,008	$1,472,565,996
1977	$1,976,327,000	$1,284,184,084	$1,402,437,262
1978	$1,240,043,000	$1,330,039,457	$1,430,614,839
1979	$1,036,763,000	$1,326,129,489	$1,458,792,417
1980	$1,121,568,000	$1,369,274,788	$1,486,969,995
1981	$1,760,855,000	$1,488,357,170	$1,515,147,573
1982	$2,640,790,000	$1,608,593,946	$1,543,325,150
1983	$2,428,104,000	$1,710,448,384	$1,587,887,113
1984	$2,392,758,000	$1,789,665,721	$1,632,449,076
1985	$2,450,324,000	$1,865,084,555	$1,677,011,039
1986	$2,307,375,000	$1,953,113,760	$1,737,957,387
1987	$1,921,362,000	$1,998,001,642	$1,749,750,580
1988	$1,922,176,000	$1,881,137,048	$1,810,696,928
1989	$1,771,608,000	$1,901,826,650	$1,855,258,891
1990	$1,561,604,000	$1,757,157,671	$1,850,667,698
1991	$1,326,286,000	$1,672,110,352	$1,878,845,276
1992	$1,390,732,000	$1,502,869,289	$1,661,257,074
1993	$1,159,157,000	$1,411,428,831	$1,640,281,496
1994	$1,441,759,000	$1,363,635,430	$1,357,155,754
1995	$889,208,000	$1,272,447,839	$1,254,258,250
1996	$821,654,000	$1,261,023,322	$1,216,898,286
1997	$1,054,673,000	$1,248,455,405	$1,212,307,094
1998	$961,763,000	$1,245,238,073	$1,224,100,286
1999	$1,441,145,000	$1,258,704,472	$1,252,277,864
2000	$1,583,921,000	$1,294,527,619	$1,280,455,441

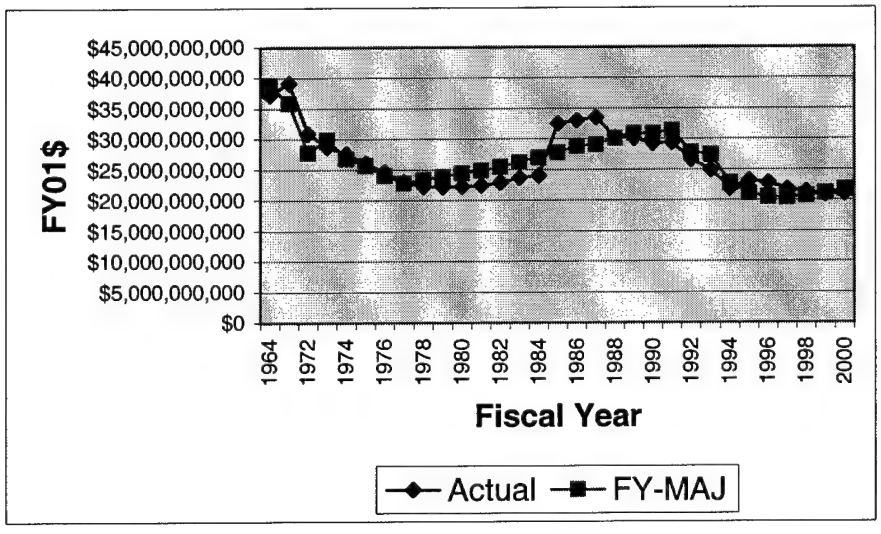
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix F: Military Personnel Regression Data

Regression Statistics	
Multiple R	0.8929674
R Square	0.7973907
Adjusted R Square	0.7829186
Standard Error	2.313E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	5.89E+20	2.95E+20	55.09851	1.96E-10
Residual	28	1.5E+20	5.35E+18		
Total	30	7.39E+20			

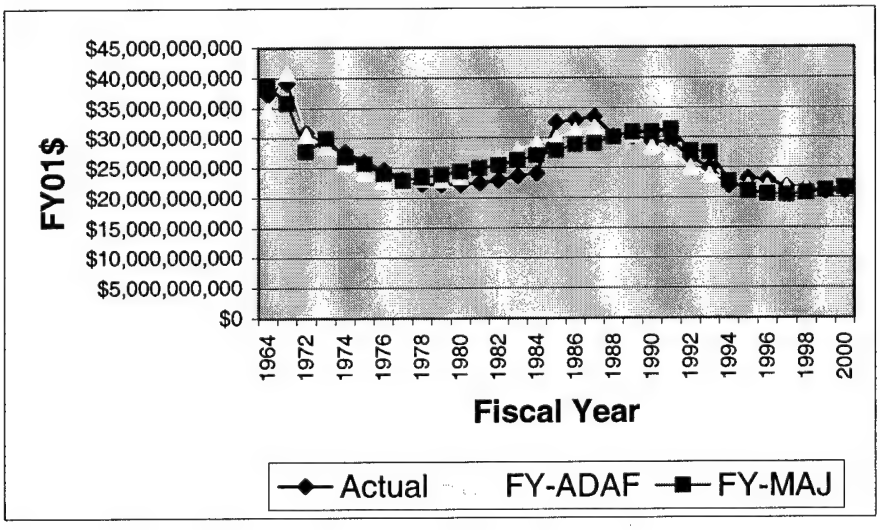
	Coefficients	Standard Error	P-value
Intercept	-1.02E+12	1.97E+11	1.7E-05
FY	509592314	97507316	1.49E-05
Major	274512024	31338371	1.64E-09



Regression Statistics	
Multiple R	0.9188878
R Square	0.8443548
Adjusted R Square	0.8332373
Standard Error	2.027E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	6.24E+20	3.12E+20	75.94818	4.9E-12
Residual	28	1.15E+20	4.11E+18		
Total	30	7.39E+20			

	Coefficients	Standard Error	P-value
Intercept	-1.31E+12	1.93E+11	2.12E-07
FY	654598674	95320772	1.84E-07
ADAF	72710.012	6985.791	3.95E-11



FY	Actual	FY-ADAF	FY-MAJ
1964	$37,215,906,000	$34,716,951,076	$38,770,020,899
1968	$39,092,780,000	$40,895,009,823	$35,867,173,720
1972	$30,921,673,000	$30,489,296,362	$27,748,598,083
1973	$28,755,657,000	$28,625,511,067	$29,905,262,541
1974	$27,610,967,000	$25,847,906,343	$26,846,198,542
1975	$26,015,162,000	$24,230,753,408	$25,708,718,711
1976	$24,634,324,000	$22,897,169,519	$24,022,214,832
1977	$23,043,264,000	$22,480,895,139	$22,884,735,001
1978	$22,243,234,000	$23,063,656,322	$23,394,327,315
1979	$22,224,196,000	$22,988,173,767	$23,903,919,629
1980	$22,220,006,000	$23,535,088,914	$24,413,511,942
1981	$22,453,190,000	$25,086,420,164	$24,923,104,256
1982	$22,936,378,000	$26,653,020,517	$25,432,696,570
1983	$23,585,890,000	$27,976,478,590	$26,216,800,907
1984	$24,064,549,000	$29,000,516,835	$27,000,905,245
1985	$32,578,759,000	$29,974,312,461	$27,785,009,583
1986	$32,970,096,000	$31,114,904,854	$28,843,625,945
1987	$33,448,954,000	$31,684,869,075	$29,078,706,235
1988	$30,184,120,000	$30,115,341,198	$30,137,322,597
1989	$30,143,906,000	$30,365,235,946	$30,921,426,934
1990	$29,227,316,000	$28,427,940,829	$30,881,995,200
1991	$29,404,567,000	$27,279,258,500	$31,391,587,514
1992	$26,625,831,000	$25,016,949,630	$27,783,499,466
1993	$24,933,189,000	$23,783,705,557	$27,469,555,707
1994	$21,909,736,000	$23,127,778,979	$22,763,419,563
1995	$23,171,517,000	$21,897,879,567	$21,076,915,684
1996	$22,861,516,000	$21,723,002,426	$20,488,459,901
1997	$21,766,355,000	$21,533,001,603	$20,449,028,167
1998	$21,409,451,000	$21,466,680,510	$20,684,108,457
1999	$20,972,712,000	$21,621,034,303	$21,193,700,770
2000	$21,064,642,000	$22,071,099,714	$21,703,293,084

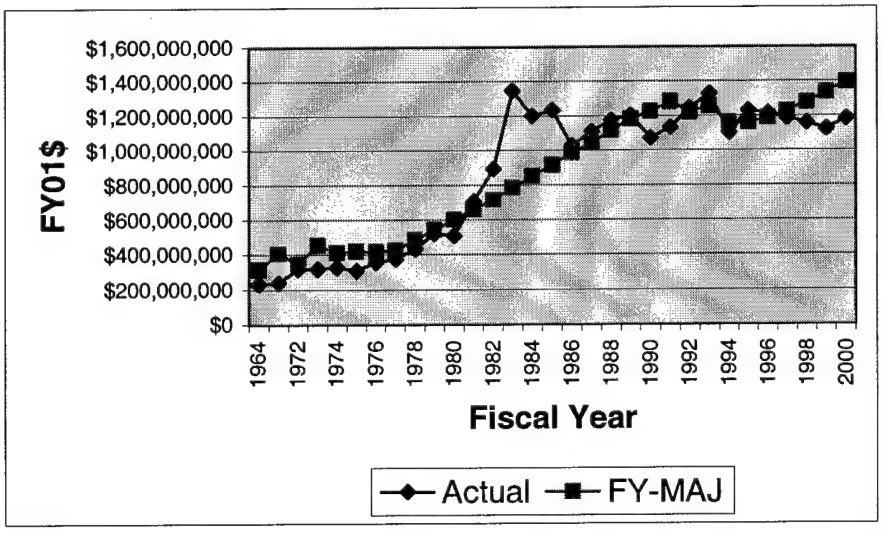
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix G: Military Family Housing Regression Data

Regression Statistics	
Multiple R	0.909255
R Square	0.826744
Adjusted R Square	0.814369
Standard Error	1.73E+08
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	4.02E+18	2.01E+18	66.8053	2.2E-11
Residual	28	8.43E+17	3.01E+16		
Total	30	4.86E+18			

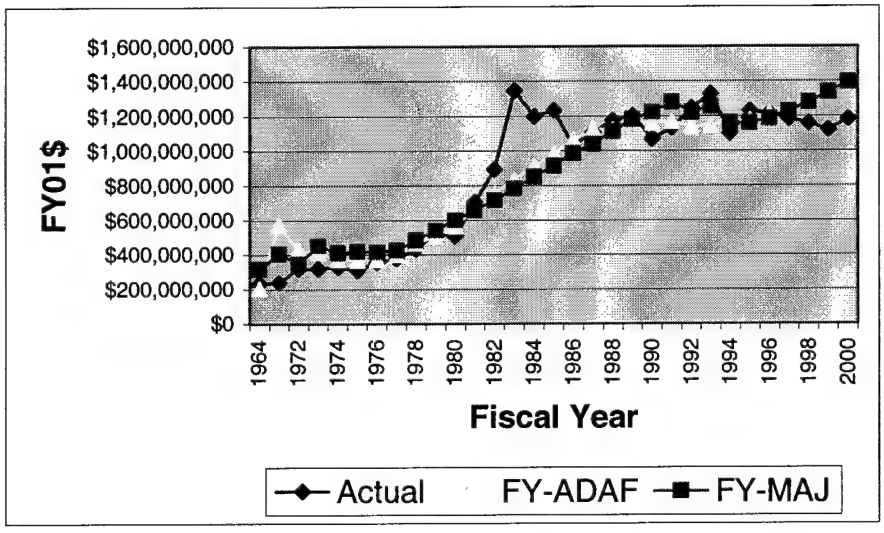
	Coefficients	Standard Error	P-value
Intercept	-1.2E+11	1.48E+10	1.58E-08
FY	58270119	7313738	1.12E-08
Major	7885578	2350599	0.002295



Regression Statistics	
Multiple R	0.9186667
R Square	0.8439486
Adjusted R Square	0.8328021
Standard Error	164631342
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	4.1E+18	2.05E+18	75.71403	5.08E-12
Residual	28	7.59E+17	2.71E+16		
Total	30	4.86E+18			

	Coefficients	Standard Error	P-value
Intercept	-1.28E+11	1.57E+10	6.65E-09
FY	64321178	7741788	4.86E-09
ADAF	2239.6404	567.3739	0.000484



FY	Actual	FY-ADAF	FY-MAJ
1964	$232,613,000	$204,710,539	$314,853,808
1968	$239,052,000	$571,641,326	$405,993,888
1972	$318,279,000	$427,752,696	$347,307,994
1973	$317,769,000	$414,501,690	$452,891,578
1974	$327,608,000	$373,102,884	$408,649,189
1975	$308,772,000	$367,448,738	$419,605,842
1976	$355,962,000	$370,529,190	$414,791,341
1977	$376,271,000	$401,864,945	$425,747,994
1978	$431,718,000	$463,973,359	$484,018,113
1979	$518,784,000	$505,806,308	$542,288,232
1980	$507,733,000	$566,810,579	$600,558,351
1981	$702,317,000	$658,753,242	$658,828,470
1982	$893,810,000	$751,166,230	$717,098,589
1983	$1,345,201,000	$836,089,860	$783,254,286
1984	$1,199,180,000	$911,790,651	$849,409,982
1985	$1,234,204,000	$985,943,851	$915,565,679
1986	$1,029,150,000	$1,065,234,785	$989,606,953
1987	$1,107,451,000	$1,126,949,022	$1,039,991,494
1988	$1,175,980,000	$1,122,761,841	$1,114,032,769
1989	$1,203,594,000	$1,174,617,181	$1,180,188,465
1990	$1,069,297,000	$1,159,101,899	$1,222,687,429
1991	$1,132,151,000	$1,167,877,756	$1,280,957,548
1992	$1,244,600,000	$1,142,351,281	$1,220,944,003
1993	$1,328,795,000	$1,148,522,437	$1,255,557,390
1994	$1,099,995,000	$1,172,476,337	$1,164,001,535
1995	$1,228,563,000	$1,178,750,516	$1,159,187,033
1996	$1,213,935,000	$1,217,521,877	$1,185,914,842
1997	$1,187,609,000	$1,255,827,393	$1,228,413,806
1998	$1,158,383,000	$1,297,942,537	$1,278,798,347
1999	$1,121,585,000	$1,346,854,989	$1,337,068,466
2000	$1,183,191,000	$1,404,876,059	$1,395,338,585

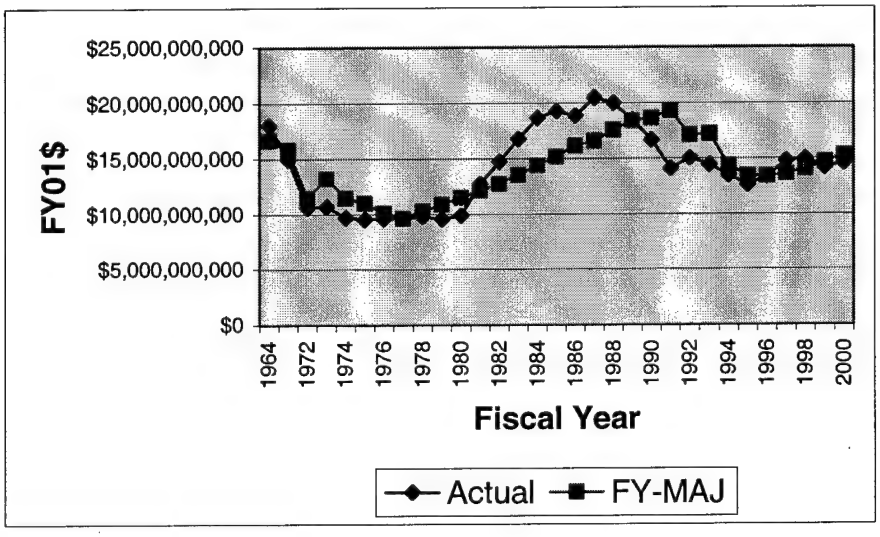
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix H: Research & Development Regression Data

Regression Statistics	
Multiple R	0.776318
R Square	0.60267
Adjusted R Square	0.57429
Standard Error	2.27E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2.18E+20	1.09E+20	21.23522	2.44E-06
Residual	28	1.44E+20	5.13E+18		
Total	30	3.62E+20			

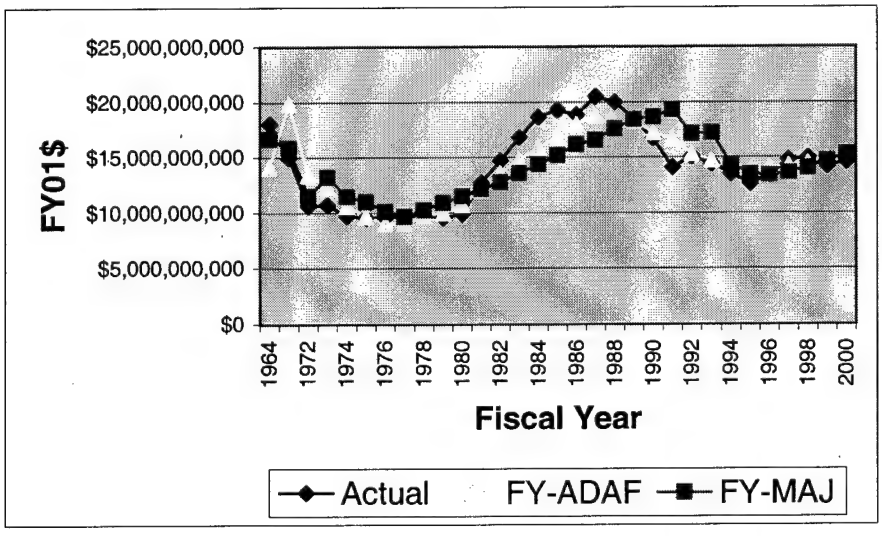
	Coefficients	Standard Error	P-value
Intercept	-1.2E+12	1.93E+11	5.73E-07
FY	6.21E+08	95525092	4.77E-07
Major	1.84E+08	30701294	1.86E-06



Regression Statistics	
Multiple R	0.865066
R Square	0.748339
Adjusted R Square	0.730364
Standard Error	1.8E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2.71E+20	1.35E+20	41.63047	4.09E-09
Residual	28	9.1E+19	3.25E+18		
Total	30	3.62E+20			

	Coefficients	Standard Error	P-value
Intercept	-1.5E+12	1.71E+11	8.66E-10
FY	7.73E+08	84793339	7.21E-10
ADAF	53067.07	6214.265	2.78E-09



FY	Actual	FY-ADAF	FY-MAJ
1964	$18,019,293,000	$14,130,685,015	$16,667,404,218
1968	$14,969,920,000	$19,818,955,133	$15,840,458,546
1972	$10,589,253,000	$13,403,634,284	$11,517,298,361
1973	$10,707,981,000	$12,338,169,522	$13,242,680,490
1974	$9,715,385,000	$10,605,757,793	$11,471,848,106
1975	$9,536,990,000	$9,720,296,541	$10,989,094,753
1976	$9,599,185,000	$9,041,796,872	$10,138,318,819
1977	$9,661,179,000	$9,032,791,390	$9,655,565,466
1978	$9,808,748,000	$9,752,927,485	$10,276,879,854
1979	$9,550,275,000	$9,992,647,372	$10,898,194,242
1980	$9,873,948,000	$10,686,621,400	$11,519,508,630
1981	$12,707,086,000	$12,113,663,967	$12,140,823,018
1982	$14,731,775,000	$13,551,850,620	$12,762,137,406
1983	$16,760,822,000	$14,812,580,982	$13,567,463,084
1984	$18,642,135,000	$15,854,781,140	$14,372,788,763
1985	$19,264,253,000	$16,860,311,950	$15,178,114,441
1986	$18,819,378,000	$17,987,578,625	$16,167,451,409
1987	$20,451,616,000	$18,698,374,915	$16,604,754,507
1988	$19,973,883,000	$17,847,672,596	$17,594,091,476
1989	$18,462,452,000	$18,324,867,632	$18,399,417,154
1990	$16,701,653,000	$17,205,752,060	$18,652,708,962
1991	$14,102,189,000	$16,662,201,957	$19,274,023,350
1992	$15,047,677,000	$15,305,876,571	$17,135,168,385
1993	$14,448,136,000	$14,700,609,462	$17,204,448,902
1994	$13,497,356,000	$14,516,694,909	$14,329,548,776
1995	$12,626,141,000	$13,913,868,886	$13,478,772,843
1996	$13,365,262,000	$14,081,046,084	$13,364,042,070
1997	$14,765,572,000	$14,237,185,332	$13,617,333,878
1998	$14,942,030,000	$14,483,591,670	$14,054,636,976
1999	$14,179,402,000	$14,891,056,573	$14,675,951,364
2000	$14,567,219,000	$15,514,345,261	$15,297,265,752

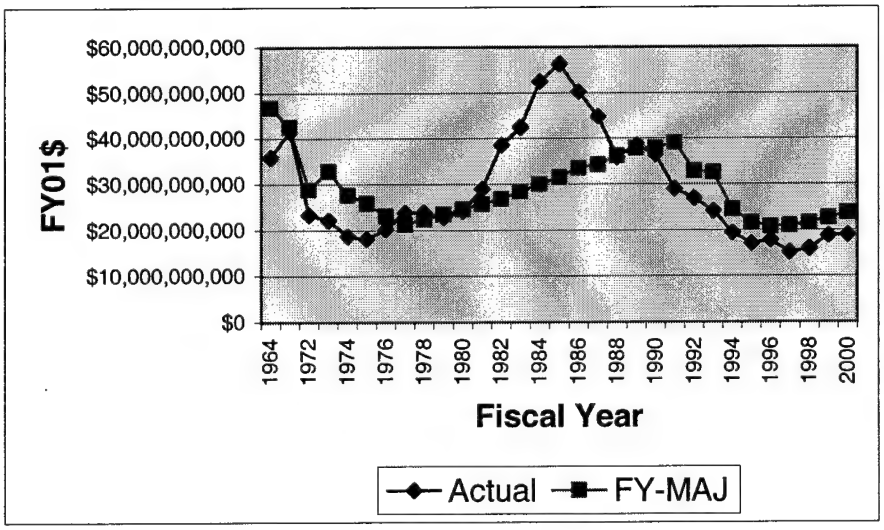
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix I: Procurement Regression Data

Regression Statistics	
Multiple R	0.5964457
R Square	0.3557474
Adjusted R Square	0.3097294
Standard Error	9.728E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	1.46E+21	7.32E+20	7.730608	0.002122
Residual	28	2.65E+21	9.46E+19		
Total	30	4.11E+21			

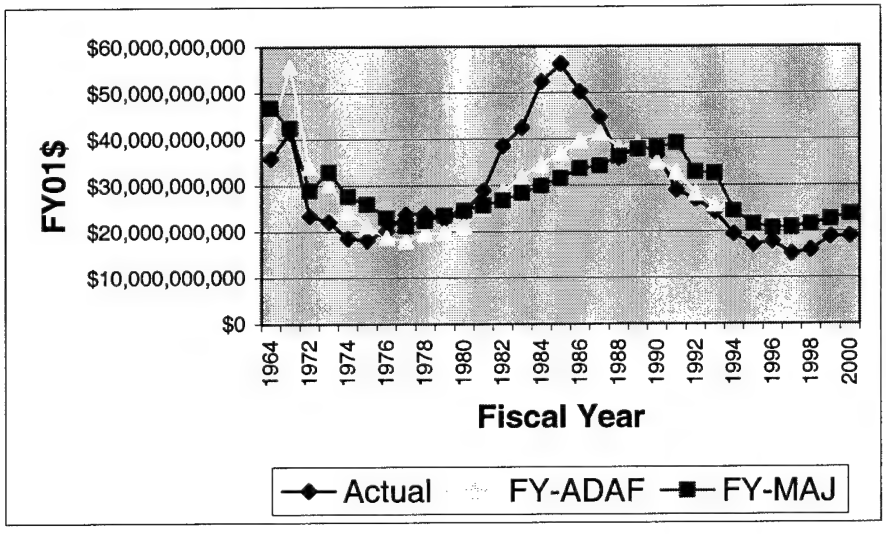
	Coefficients	Standard Error	P-value
Intercept	-2.22E+12	8.3E+11	0.012372
FY	1.1E+09	4.1E+08	0.012141
Major	486120971	1.32E+08	0.000964



Regression Statistics	
Multiple R	0.75049717
R Square	0.56324601
Adjusted R Square	0.53204929
Standard Error	8009329955
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	2.32E+21	1.16E+21	18.05466	9.19E-06
Residual	28	1.8E+21	6.41E+19		
Total	30	4.11E+21			

	Coefficients	Standard Error	P-value
Intercept	-3.513E+12	7.62E+11	8E-05
FY	1739855078	3.77E+08	7.85E-05
ADAF	159440.649	27602.79	3.35E-06



FY	Actual	FY-ADAF	FY-MAJ
1964	$35,886,820,000	$40,933,959,689	$46,834,317,964
1968	$41,492,628,000	$55,699,115,845	$42,483,715,989
1972	$23,363,788,000	$34,098,889,380	$28,896,815,570
1973	$22,115,232,000	$30,316,358,146	$32,913,435,269
1974	$18,637,627,000	$24,529,976,838	$27,693,756,524
1975	$18,150,296,000	$21,288,268,284	$25,876,924,574
1976	$20,201,298,000	$18,668,378,261	$23,087,850,683
1977	$23,749,846,000	$18,059,991,464	$21,271,018,733
1978	$23,840,116,000	$19,642,319,181	$22,370,912,608
1979	$22,730,159,000	$19,781,230,704	$23,470,806,483
1980	$24,082,380,000	$21,284,954,182	$24,570,700,357
1981	$28,959,506,000	$24,991,190,782	$25,670,594,232
1982	$38,539,190,000	$28,730,909,918	$26,770,488,106
1983	$42,473,697,000	$31,937,459,524	$28,356,502,952
1984	$52,466,041,000	$34,487,432,539	$29,942,517,797
1985	$56,259,026,000	$36,927,232,066	$31,528,532,643
1986	$50,197,043,000	$39,732,788,440	$33,600,668,459
1987	$44,735,721,000	$41,287,054,603	$34,214,441,363
1988	$35,876,788,000	$38,149,779,675	$36,286,577,179
1989	$38,483,771,000	$39,002,188,102	$37,872,592,024
1990	$36,444,036,000	$35,058,462,372	$38,000,243,957
1991	$28,919,019,000	$32,844,029,919	$39,100,137,832
1992	$26,941,851,000	$28,187,604,489	$32,908,217,145
1993	$24,168,594,000	$25,787,742,561	$32,549,748,108
1994	$19,396,263,000	$24,653,839,385	$24,413,343,538
1995	$17,105,493,000	$22,261,311,727	$21,624,269,647
1996	$17,823,062,000	$22,182,267,884	$20,779,679,639
1997	$15,143,239,000	$22,070,060,385	$20,907,331,572
1998	$15,930,479,000	$22,229,061,431	$21,521,104,476
1999	$18,812,967,000	$22,871,964,845	$22,620,998,350
2000	$18,933,160,000	$24,163,313,378	$23,720,892,225

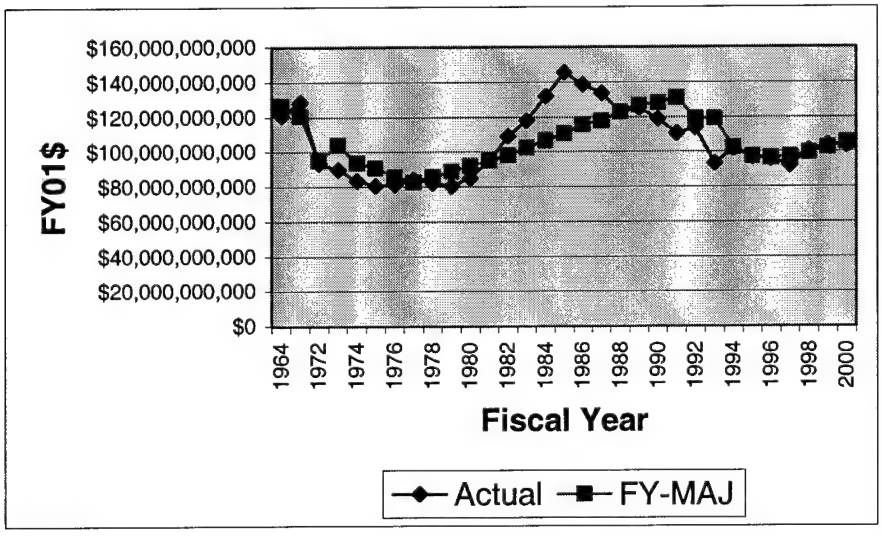
Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

Appendix J: Total Air Force Regression Data

Regression Statistics	
Multiple R	0.739483
R Square	0.546835
Adjusted R Square	0.514466
Standard Error	1.32E+10
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	5.9E+21	2.95E+21	16.89384	1.54E-05
Residual	28	4.89E+21	1.75E+20		
Total	30	1.08E+22			

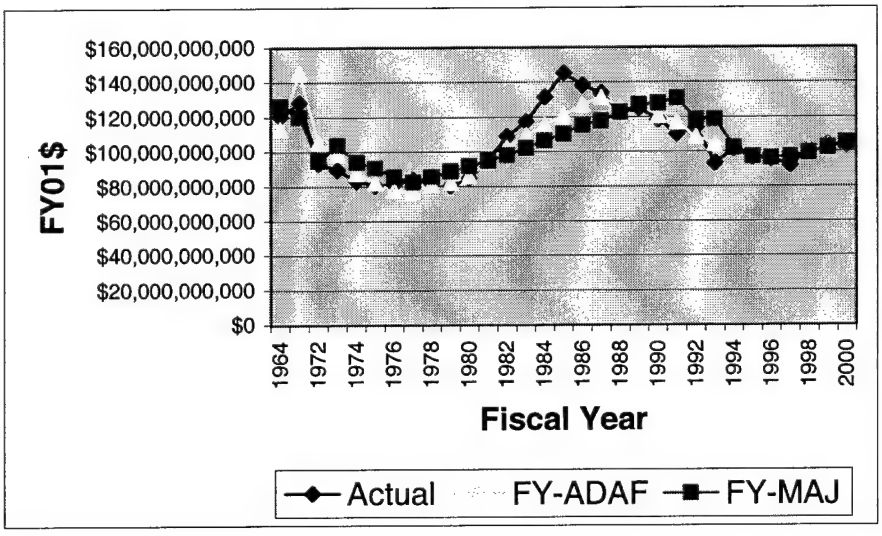
	Coefficients	Standard Error	P-value
Intercept	-6.2E+12	1.13E+12	7.43E-06
FY	3.1E+09	5.57E+08	6.02E-06
Major	1.03E+09	1.79E+08	3.81E-06



Regression Statistics	
Multiple R	0.898113
R Square	0.806607
Adjusted R Square	0.792793
Standard Error	8.64E+09
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	8.71E+21	4.35E+21	58.39137	1.02E-10
Residual	28	2.09E+21	7.46E+19		
Total	30	1.08E+22			

	Coefficients	Standard Error	P-value
Intercept	-8.5E+12	8.21E+11	5.03E-11
FY	4.22E+09	4.06E+08	4.01E-11
ADAF	318481	29761.37	2.11E-11



FY	Actual	FY-ADAF	FY-MAJ
1964	$120,613,329,000	$113,224,791,114	$126,433,403,483
1968	$128,476,129,000	$145,711,848,637	$120,357,311,492
1972	$93,438,859,000	$105,559,441,080	$94,783,636,557
1973	$89,714,574,000	$98,752,328,941	$104,039,593,607
1974	$83,330,129,000	$87,942,547,588	$93,797,967,713
1975	$80,519,701,000	$82,215,723,003	$90,739,661,851
1976	$81,351,003,000	$77,730,974,319	$85,628,978,837
1977	$83,837,048,000	$77,264,181,939	$82,570,672,976
1978	$81,995,658,000	$81,173,318,506	$85,669,498,570
1979	$80,454,983,000	$82,199,246,575	$88,768,324,163
1980	$84,731,631,000	$85,951,372,008	$91,867,149,757
1981	$95,323,554,000	$94,102,993,983	$94,965,975,351
1982	$108,971,375,000	$102,321,496,967	$98,064,800,945
1983	$117,608,877,000	$109,474,999,486	$102,189,815,115
1984	$131,567,436,000	$115,316,997,245	$106,314,829,285
1985	$145,265,009,000	$120,938,924,632	$110,439,843,455
1986	$138,296,721,000	$127,291,447,435	$115,591,046,201
1987	$133,633,029,000	$131,144,531,346	$117,663,683,219
1988	$122,747,300,000	$125,626,311,816	$122,814,885,964
1989	$125,076,136,000	$128,077,442,362	$126,939,900,134
1990	$118,525,110,000	$120,948,345,932	$127,986,348,576
1991	$110,268,904,000	$117,273,494,433	$131,085,174,170
1992	$113,720,918,000	$108,720,787,930	$118,791,171,125
1993	$93,290,579,000	$104,675,543,028	$118,811,430,991
1994	$101,606,758,000	$103,159,037,270	$102,412,673,642
1995	$96,580,285,000	$99,128,442,493	$97,301,990,628
1996	$95,904,943,000	$99,719,007,034	$96,296,061,918
1997	$92,181,565,000	$100,243,327,528	$97,342,510,360
1998	$100,805,618,000	$101,309,384,203	$99,415,147,378
1999	$104,039,573,000	$103,342,030,714	$102,513,972,972
2000	$103,333,525,000	$106,669,939,455	$105,612,798,566

Notes:
(1) "FY-ADAF" is the result of regressing the budget by fiscal year and active duty Air Force members.
(2) "FY-MAJ" " is the result of regressing the budget by fiscal year and major installations.

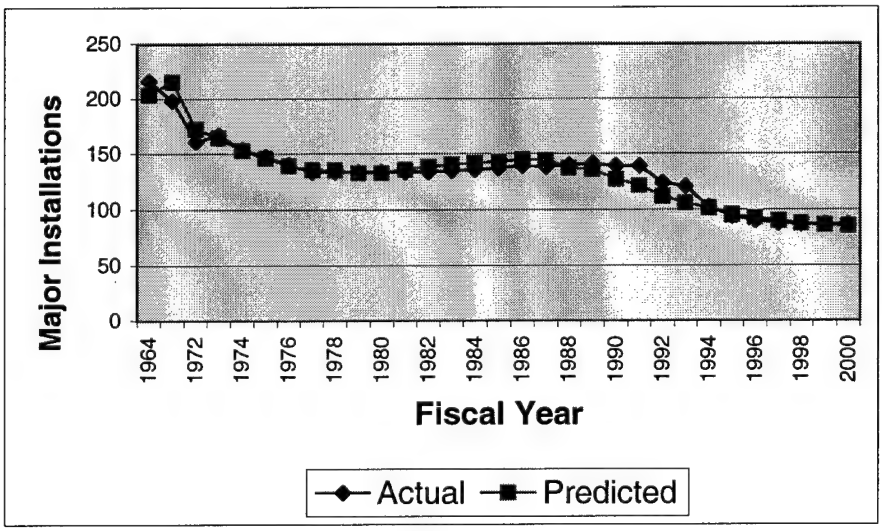
Appendix K: Active Duty Personnel versus Major Installations Data

Regression Statistics	
Multiple R	0.968159
R Square	0.937333
Adjusted R Square	0.903999
Standard Error	7.506573
Observations	31

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	25284.64	25284.64	448.7178	3.44E-19
Residual	30	1690.459	56.34864		
Total	31	26975.1			

	Coefficients	Standard Error	t Stat	P-value
Intercept	0	#N/A	#N/A	#N/A
ADAF	0.000238	2.36E-06	100.64	1.64E-39

Note: When you exclude the intercept (which forces it to zero), there are no significance statistics, therefore, Excel prints N/A for "not applicable".



FY	Actual	Predicted
1964	216	204
1968	198	215
1972	161	173
1973	167	164
1974	154	153
1975	148	146
1976	140	139
1977	134	136
1978	134	135
1979	134	133
1980	134	133
1981	134	136
1982	134	139
1983	135	141
1984	136	142
1985	137	143
1986	139	145
1987	138	144
1988	140	137
1989	141	136
1990	139	127
1991	139	121
1992	124	112
1993	121	106
1994	102	101
1995	94	95
1996	90	93
1997	88	90
1998	87	87
1999	87	86
2000	87	85

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Vita

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His first assignment was to the 354th Comptroller Flight, Eielson AFB, Alaska where he worked as the Chief of the Financial Services branch, and subsequently as the Deputy Chief of the Financial Analysis branch. While stationed at Eielson, he deployed in January 1999 for six months to serve as the Financial Services Officer and Central Air Force Disbursing Agent, Joint Task Force-Southwest Asia, Riyadh, Kingdom of Saudi Arabia, in support of Operation SOUTHERN WATCH. In August 1999, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to the Air Force Cost Analysis Agency.

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14. ABSTRACT

This thesis uses regression to analyze the savings resulting from the previous four rounds of BRAC in terms of their affect on each of the Air Force budget appropriations. For each appropriation, while the number of major installations initially appears to be a significant determinant in explaining the change in the budget, the number of bases becomes insignificant if a surrogate for Air Force mission requirements is included as the explanatory variable. We tested three surrogate measures for mission requirements: number of flying hours, number of aircraft, and number of active duty personnel. In each case, we found the number of active duty Air Force members to be a better predictor of the budget level than the regression model that included the number of major installations. We conclude that mission requirements are a better indicator of the required funding than the number of major installations.

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